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FEBRUARY, 1850.

CIVIL ENGINEERING.

*The Britannia Bridge—Progress of the Work.**

[Although the Britannia Bridge for railway traffic across the Menai Strait does not yet hang in mid air, there has been no real delay in the process of raising it. On the contrary, while the process adopted is somewhat slower than that originally contemplated, it is one that takes an efficient guarantee against calamity. The published accounts are, for the most part, very confused and inaccurate; but our readers will be able to understand what is going forward from the account with which we have been favored by a scientific correspondent.]

The tube, by the operation of floating, was left resting at the foot of the towers, each end being there supported on a shelf of stone, so that, at the highest state of the tide, there was a space of about three feet between its bottom and the water. Here, until last Friday, it remained while the preparations were making in the upper part of the towers for raising through the 100 feet necessary to attain the "103 feet above high water spring tides" demanded by the Admiralty, both in this case and in that of the Menai Bridge.

These preparations consist of an hydraulic press of immense power in each tower, with the steam engine and pumps necessary for the working of each; and of the lifting chains which hang down from the presses and take hold of the recumbent tube below. These chains had to be put together on the top of the tube, and then got up from thence into their dependent position. They do not consist of short links one within the other, like a common chain, but are like those of a suspension bridge, the links being six feet long.

The hydraulic press is placed in the highest part of the tower, so as to

* From the London Mechanics' Magazine, for August, 1849.

be clear above the tube when lifted into its ultimate position. It consists of a close cylinder of great strength, with a ram or solid piston working through a water-tight collar in the top; the ram bearing across its top a cross head or beam of cast and wrought iron in combination, to each end of which is fastened the upper end of each line of lifting chains, of which there are two at each end of the tube. The immense scale of the whole thing may be judged from the fact that this cross head alone weighs more than 15 tons, and the two lifting chains at each end about 50 tons; of themselves they look quite a sufficient load for the press without the 1800 tons below. As this ram rises from the pressure of the water thrown into the cylinder by the pumps, the cross head rises too, carrying up with it the chains and therefore the tube, till a "stroke" of six feet is completed.

Here the operation stops, and means are taken to secure the chains at the foot of the press, while the ram is being lowered to the bottom of the cylinder again. This is done (and in less time than its description has taken) by clipping the links of the chain with "clams," which are blocks of iron able to be brought near together by a screw like the sides of a vice; they are supported on the beams on which the press rests, and are made to fit under "shoulders" or notches at each joint of the chain. This being done, the ram is lowered down, the top length of chain above the clams taken off, connexion again made to the cross head, and all is ready for another lift. It was the original intention of Mr. Stephenson, having once begun to lift, to do so at both ends simultaneously, and so to continue, making consecutive lifts as fast as possible, by which the whole would have been accomplished in about eighteen hours; but the terrible consequences of any failure in the chains, during the time when the dead weight would have been hanging on them, has made him adopt a slower method, in which one lift of six feet is made in the twenty-four hours, first at one end and then at the other, the tube being followed up underneath by wood packings, which, during the remainder of the day, are taken out and replaced by solid masonry. The lift takes on an average 38 minutes. The operation was begun on Friday evening, (10th August,) and the whole height reached to-day (16th August) is 27 feet, everything having hitherto proceeded without the least impediment or failure.

The second tube, which will be the continuation of this one, will be floated immediately after the raising is completed—probably about the middle of September; and it will be lifted without delay.—*Spectator*, *Aug.* 18.

Since the above was written, the following account of an unfortunate interruption to the progress of the works has appeared in the *Liverpool Journal:*—

BANGOR, Friday Evening, Aug, 17, 1849.

"All the fond and desired hopes of a successful realization of raising the monster tube of this stupendous bridge to its final resting place are, for the next two months at least, suspended.

"A few minutes before noon of this day, the lower part of the cylinder of the huge hydraulic press on the Anglesea side burst with a tremendous explosion, and in its descent on to the tube, a height of about 84 feet, fell with a terrific crash. The press was at work at the time, and had raised the tube about three feet during the lift this day; and had it not been for the very urgent and precautionary means adopted by packing and bricking

under with cement as the tube was being raised, the most dreadful consequences were inevitable.

"One of the workmen was precipitated from a rope ladder running from the top of the tube to the recess in which the hydraulic machine was fixed; he was struck by the huge mass of iron in its descent, weighing nearly three tons, and now lies in a dreadfully crushed state.

"Mr. Frank Forster, the resident engineer, with his staff, was quickly on the spot, and I am happy to add that no other accident has happened.

"This most disastrous affair is to be attributed entirely to a defective casting of the cylinder, and the raising of the tube will, consequently, be delayed some time until the completion and fixing of the new one in its place. The tube is now raised about 21 feet from the base."

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*The First Great Tube of the Britannia Bridge.**

On Saturday forenoon last, (October 13,) the first great tube, (or iron tunnel,) out of four tubes between the towers, required for the double line of the Chester and Holyhead Railway, in crossing the Menai Straits, was safely hoisted to its final resting place or level, without accident to life or limb. Each tube weighs about 1800 tons, and contains about 317,000 rivets. The stone work, including the abutments, comprise about 1,500,000 cubic feet. The one just elevated was hoisted by two 40 horse power steam engines, one at the top of one tower and one at the top of the other, and both acting on powerful hydraulic machines, lifting chains six feet in length of link. All the preparations are complete for the floating of the next tube, which will take place about the middle of November. The day at present fixed on, should no unforeseen contingency occur, for the completion of one highway, and the transit of the first train over the Straits, is the 1st of March next. The hoisting is conducted by Mr. Clarke and Mr. Amos; Captain Claxton, R. N., superintends the floating off of the tubes.

Coal Mining Three Hundred Years Ago.†

In this age of experiment, it may be interesting to know some of the fancies in connexion with coal mining in past times. In the Bodlein Library there is a manuscript, written in Greek, by one Nivander Nucius, from which the following has been extracted:—"In this city (Ciege) and all the neighboring country, they are accustomed to burn a certain black, shining, stony substance, producing hot embers without smoke; but when the substance (coal) has been consumed, it yields no cinders, but a very fine dust, which is scattered through the air. These stony substances they dig out of the deepest recesses of the earth, finding certain veins from which they extract them; but a peculiar prodigy takes place when they are about to commence digging. The miners are accustomed to excavate at a distance of eight or more stadia from the city, below the river, about 30 cubits or more. When they meet with this mineral, they form a spacious cavern;

* From the London Railway Magazine, October 20, 1849.
† From the London Mining Journal, No. 725.

but they are not able to throw out the mineral immediately, for fire on a sudden bursts forth, and encompasses the whole cavern. When the miners are desirous of extracting the coal, they put on a linen garment, which has neither been bleached nor dipped in water; this covers them from head to foot, leaving only certain apertures for the eyes; they also take a staff in their hands, which serves to guide and direct their steps in the passage leading to the cave. The miner then draws near to the fire, and *frightens* it with his staff. The fire then flies away, contracting itself little by little. Having then expended itself, it collects itself together in a surprising manner, and becomes very small, remaining quite still in a corner. But it behoves the man wearing the linen garment to stand over the flame when at rest, always terrifying it with his staff. Whilst he performs this service, the miners extract the stones; but as soon as they have left the cave, the dormant fire on a sudden bursts forth, and environs the whole cave. No one then ventures to enter without the aforementioned garment and staff, for he would be inevitably consumed. And this we ourselves have beheld, being admirers of the operations of Nature." Can modern science unriddle the mystery of the garment and staff?

A New Method of Graduating Levelling Staves, by which they may be much more accurately read, and at much greater distances, than at present. By Mr. J. D. Pemberton.*

At the present time, when drainage of towns with reference to sanitary arrangements, and drainage of lands in connexion with agricultural improvements, engage so large a portion of public attention, the suggestion of any real improvement in the instruments usually employed in practical levelling, is certain to be listened to with attention, if not with approval, by the numerous body of professional gentlemen now occupied in conducting the operations alluded to. The great benefit conferred upon engineers and architects, as a body, by Mr. Gravatt, by the arrangement which superseded the use of the sliding-vane in levelling staves, is too well known and appreciated to require comment: while, however, Mr. Gravatt's method is in general far superior to the old one, there are two particulars in which it is usually admitted to be inferior to it—viz. 1st, *the trouble and attention required to read the minute divisions on the staff*—an important point when we reflect on the vast number of readings taken in a single day's levelling; and, 2d, *the difficulty of reading them at any considerable distance.* In order to remedy these defects, several eminent engineers and others have, at different times, proposed methods of graduating, which, however, seem to have failed to supersede that originally introduced by Mr. Gravatt. To ascertain the reason of this, as well as their comparative merits in connexion with some by other engineers, I made a series of experiments on all such levelling staves, of new construction, as I could meet with; a very brief account of the results of which may not be uninteresting, and should perhaps, in justice to the inventors, accompany these remarks, in which shall be proposed a method of graduating levelling staves, which will, I

* From the London Civil Engineer and Architect's Journal, for December, 1849.

believe, entirely get rid of the two difficulties already mentioned, without any counterbalancing disadvantage. Two levels were used, a 10-in. and a 12-in. focus of Troughton's, in the experiments. The staves compared were as follows:—

No. 1. Mr. Gravatt's: 10ths clearer and more readable at long distances than, perhaps, in any other; 100ths read generally with distinctness at about 8 chns.—10 chns. should not be exceeded; in this Mr. Williams coincides in his "Practical Geodesy," p. 63. On the whole, this staff has the advantage of all that have appeared since; in which opinion I am supported by Mr. Bourne in his "Principles and Practice of Engineering," p. 210.

No. 2. A mode of dividing, invented and adopted by Mr. P. N. Barlow, C. E.; the object being to obtain greater distinctness and less liability to error. The divisions are composed of triangles, each occupying $\frac{1}{20}$ths of a foot, except that at the even tenth, which is diamond-shaped, to render it more defined than in other staves. The chief advantage of this arrangement consists in the greater distinctness with which the point of intersection of the triangle, and the hair-line of the telescope is defined, compared with the horizontal divisions, and their parallelism with the hair-line. The peculiar difficulty of setting two parallel lines to coincide with one another is well known to astronomical observers, who can bisect a dot with greater precision than two of the finest lines are known to agree.—*vide Encyc. Metrop.*

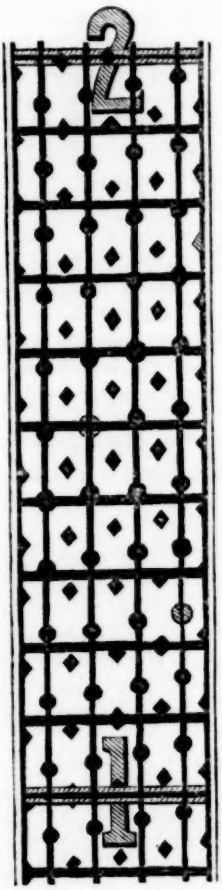
No. 3, preferred by Mr. Castle, ("Land Surveying," p. 255,) goes by the name of "Stephenson's," and was first used on the London and Birmingham. The 100ths are obtained in the same way as in the common ivory protractor; the 10ths of a foot through the whole length of the staff are bisected, making the two divisions 20ths; and these division lines extend the whole breadth across the staff. The opposite ends of these lines are connected by diagonal lines, each one with its preceding—viz., the left of No. I. with the right of No. II., the right of No. II. with the left of No. III., and so on. And five vertical lines are drawn, at equal distances, along the whole of the staff, which thus divides each of these diagonal lines into five equal parts, each being $\frac{1}{5}$th part of $\frac{1}{20}$th, or $\frac{1}{100}$th part of a foot.

No. 4. Mr. Sopwith's: this on trial seemed altogether too complicated, and the subdivisions too minute. Mr. Bourne's remarks on this staff seem decidedly judicious—page 211 of the work before quoted: "Several attempts have been made at improvements in this (Mr. Gravatt's) staff, but their success is very problematical. Mr. Sopwith, for instance, has introduced one in which distinctive figures are attached to every-other 100th of a foot; the mechanical construction also differs from this,—it is more elaborate, which consequently makes the staff more expensive. It is very neat, however, but is subject to injury in windy weather."

No. 5. A staff of my own invention, constructed with cylinders of block tin, the largest 3½ inches diameter, to slide one within another, which seemed to afford great strength and lightness, and formed, besides, a case to carry plans in,—the particular object aimed at being, by obtaining a surface of 9 to 11 inches, to mark every 100th of a foot by a dot and figure, running in a spiral line from bottom to top; it should, of course, revolve

slowly during observation. On actual trial, however, Mr. Gravatt's staff seemed preferable.

No. 6. A staff which, on actual trial, seems capable of being read with more distinctness at short distances than any staff now in use, and with facility at between four to five times the usual distance; it is graduated by an application of the *upright vernier*, the principle of which is usually expressed in the formula,



$$(n-1)\,\mathrm{L} = n\,\mathrm{V};$$

$$\therefore\ \mathrm{L}-\mathrm{V} = \mathrm{L}-\frac{n-1}{n}\,\mathrm{L} = \frac{1}{n}\,\mathrm{L}$$

L and V being the length of a division on the staff and vernier respectively. And since to propose any form of sliding vernier would have been at once rejected, as introducing the old vane in a new form, I have got over the difficulty in the following manner:—

By inspecting the diagram, it will be seen that there are 9 rows or columns of stars or dots, which it is impossible to confuse in a lateral direction one with another. The initial position of the first star in the first of these rows is zero on the staff; the others follow in regular succession at intervals of 100th foot between each; then, all the stars in any one row are $\frac{9}{100}$ths of a foot from centre to centre, while the lines drawn across mark $\frac{1}{10}$ths of feet as usual: one star will therefore be found at every $\frac{1}{10}$th-foot, which is useful to recollect in graduating a staff in this manner.

In reading such a staff, we first read the feet and $\frac{1}{10}$ths of feet as usual; then, suppose the cross-hair of the diagram to occur anywhere within some particular $\frac{1}{10}$th, observe which dot or star it intersects, then count dots or stars upwards, in its vertical line, until a coincidence with a horizontal line is found: the numbers so counted will represent $\frac{1}{100}$ths of feet, and consequently give us the second decimal place.

The great advantage gained is simply this: that whereas in all the staves now extant, we are obliged to distinguish between hundredths, to obtain the second place; in this levelling staff, we attend to no subdivisions less than $\frac{9}{100}$ths-foot apart, to obtain equal accuracy. On trial, it will be found that this staff can be read with *facility* at $\frac{1}{4}$-mile sights. I found it practicable at 35 and 40 chains, with a 12-in. focus.

I should recommend the horizontal lines to be put in in vermillion, as the contrast between black and vermillion will be found distinct at the utmost distance at which any staff can be read.

Royal Agricultural College, Cirencester, Nov. 9, 1849.

Report on recent Applications of the Wave Principle to the Practical Construction of Steam Vessels. *By* MR. J. SCOTT RUSSELL.*

During the last year I have had more than one opportunity of applying the wave principle to the construction of steam vessels. There is one case, however, in which I have been able to apply it to practice under circumstances of greater complexity and difficulty than have ever occurred to me, and where it has been successful in overcoming difficulties to a greater extent, and in a more decided manner, than heretofore.

During the last year a very difficult problem was proposed to me. It was this:—To build a steam vessel that should be fast without great length, a good sea-boat without drawing much water, and to carry a great top weight and yet swim very light. Besides, this vessel was to be able to go backwards as well as forwards equally well; and, though a small boat, was to contain great accommodation. The problem is one to which the wave principle is far from seeming peculiarly applicable. In the first place, it is well known that the wave principle prescribes a different form of the bow from that of the stern, in order to obtain most speed with least cost of power. In the second place, it is known that a high speed requires, on the wave system, a very considerably greater length than was here allowed for the entrance of the vessel or the lines of the bow. It would, therefore, seem at first to be a case that would prove too difficult for the successful application of the wave system.

There is one more feature in the case which gives it interest. At the same time the same problem was worked out by another party on another plan of construction, *not* on the wave principle. Another vessel was built under similar conditions, with engines of the best construction, made by one of the most eminent engineers in England. Both of these vessels were built at the same time, and tried under similar circumstances; therefore, here was a case in which the practical value of the wave principle has been brought to a test more direct and less questionable than any that was likely to have occurred—and, therefore, more important to be placed on the records of the British Association.

The first question which will naturally occur to a member of this Association, who recollects this principle, will be this: How could you apply the wave principle in a vessel made to go equally well both ways? The first answer is ready—it is this, that the vessel cannot be made to go only one way—seeing that, in one case, she would have a best possible bow and a best possible stern, and in the other case could have neither. The next point is this; that, in both cases of bow and stern, it was necessary to have a compromise. Each required to be in turn bow and stern,—this was accomplished in the following manner:—If there be any point which has more forcibly struck me in the application of the wave principle than another, it is the flexibility of the wave principle,—the extent to which it admits of deviations from its strict rules without losing the benefit of its assistance. If it had unluckily been true of this system, that it prescribed an exact mathematical solid in its three dimensions, (like Newton's Solid of least Resistance,) to which implicit adherence was imperative on pain

* From the London Civil Engineer and Architect's Journal, for November, 1849.

of losing all the benefit proffered, then, indeed, the system would have been (like Newton's) of little use, from the fact that, from causes independent of resistance, ships cannot be solids of revolution, consistently with other qualities. The wave principle, on the contrary, possesses wonderful flexibility; first, from the circumstance of its prescribing lines *in one plane* only, and so leaving the other two dimensions in the hands of the practical constructor,—so that the sections of the vessel in one plane being given by the system, the sections in two others are at the service of the constructor. I had, in this case, to lay down for both ends of the vessel, that which is best for a bow and that which is best for a stern, at the given velocity. I had next to place relative values on bow resistance and stern resistance. I had next to single out from between those two lines one which, taken either as bow or stern, would deviate least from either, and so have least resistance on a mean of both directions. This, therefore, the wave principle did;—it gave the limits, and gave also the choice of a series of means, all more or less suited to the purpose intended. I have now shortly to state the practical details by which this process was carried into effect, and the results arrived at in consequence.

The engines of the vessel, as well as the vessel, had to be constructed by my partner, Mr. A. Robinson, and myself, and we were enabled to adapt the one to the other with greater ease and certainty than in all likelihood we could have done had the engineer been separate from the shipbuilder. In our case, the engine was considered and made an actual portion of the ship, and the ship of the engine. It will be fair, therefore, to deduct from the good effects attributed to the wave form of the ship such advantages as we possessed in building both engines and boilers, and ship, as one whole;—still it is fair to remember, on the other side, that the builders of the engines with which ours had to compete, have been celebrated for their efficiency, and for the large actual power they have developed, when compared with their nominal power. It should also be remembered, that the builders opposed to us had previously built the fastest boats of their district. The results obtained are as follows:—Both vessels were about 150-55 feet long; 22-22½ feet beam; 4 feet draft of water; 240 tons displacement; 150-horse power, nominal; propelled by oscillating cylinders of 48 inches diameter, with the same proportion of stroke to paddle wheel in both cases; and with only such differences as the engineers and shipbuilders in each case considered likely to be most successful in carrying out the execution of their work to the best advantage. The terms prescribed to both builders by the engineer of the proprietors being identical, and with only such latitude as should not form an obstacle to whatever might seem best suited for obtaining greatest efficiency.

Results of Experiments on Velocity with equal Power.

	Wave vessel.	Competing vessel.
Speed,	16·13	15·03 miles per hour.
Power,	20·30	19·90 velocity of wheel.
Loss,	4·17	4·87 slip of wheel.

These are the results of accurate trials, at the measured mile, made both with the tide and against it. It is important to observe the amount of slip, as it serves to show that it was no deficiency of the engine power which

caused the difference, both engines having gone at, as nearly as possible, the same speed. In order that the statement just given may not lead to false conclusions, it is necessary to state what where those minor differences in vessel and engine which each constructor adopted as tending to greater efficiency. The wave vessel had a flatter floor, and considerably squarer on the midship section, which was done for diminishing the depth of water as wanted for her use. In the other vessel, the consideration of draft of water was rejected or overlooked, and a finer midship section taken, although with a larger draft of water. In one case, also, the rudders were considered as part of the length of the vessel, and treated accordingly, and, in the other case, rejected from it. In the engines, also, although the diameters of the cylinders were identical, the stroke of the wave vessel was somewhat longer than the other, but the diminished effective diameter in the shorter stroke reduced them to nearly the same proportion. Thus far, the experiments given only serve to prove that, practically, a considerably better result has been obtained by a steam vessel built on the wave principle, than a competitor built under conditions that are perfectly identical, in so far as the public and the owners are concerned. But as regards the purely scientific question, I shall add two other experiments with the wave vessel, which furnish data of a more permanent and precise nature—one at a higher, the other at a lower velocity:—

Experiments on the Wave Vessel.

I. Velocity of vessel, 15·14 miles an hour.	II. Velocity of vessel, 16·50 miles an hour.
" of wheel, 18·17 "	" of wheel, 21·20 "
Slip, 3·03	Slip, 4·70

The area of midship section immersed was 89·4 feet.
The surface of vessel immersed was 3080·0 feet.
The area of paddle floats was 26·8 feet.

The conclusion which I deduce from these last experiments is this, that, by means of the wave form, one may obtain a form of which the resistance shall be represented by $R = \frac{1}{20} A H S$, instead of $R = \frac{1}{6} A H S$, which is the lowest number given in any previous system of construction;—A, being the area of midship section, H, the height due to the velocity of the vessel, and S, the weight of a cubic foot of water.—*Proc. Brit. Assoc.*

Improvements in Fixed and Revolving Lights, being a New Dia-Catoptric Instrument for Increasing the Intensity of the Light. By THOMAS STEVENSON, ESQ., F. R. S. E., C. E.*

The author stated that this instrument is composed of three parts—a paraboloidal mirror, having the conoidal portion behind the parameter cut off, and its place supplied by a hemispherical reflector, whose centre thus coincides with the focus of the paraboloid, while in front of the flame is placed an annular lens subtending at the focus of the paraboloid, the same angle as that which is subtended at that point by the greatest double ordinate of the reflector, and having its principal focus coincident with that of the paraboloid. This instrument should theoretically produce the most in-

* From the London Civil Engineer and Architect's Journal, for November, 1849.

tense light yet derived from any given flame, as it encloses and parallelizes each ray of the whole sphere of light, so that none are lost by divergence between the lips of the reflector, where, in the present arrangement, not very much short of one-half of the light is lost.

In this instrument, the hemispherical reflector throws the light which it receives (viz., the posterior half of the sphere of light) through the focus of the paraboloid, and while the outer ring of this light is received by the paraboloid, and parallelized by it, the central cone is received by the annular lens, and is also parallelized. The outer ring of the anterior half of the sphere of light is received directly by the paraboloid, and is parallelized by it; while the central cone of rays, which, in the present arrangement, is lost by natural divergence, is received by the annular lens, and is parallelized by it. Thus the whole sphere of light is economized. This combination may also be applied *mutatis mutandis* to the illumination of half of the horizon of a fixed light, by means of a single light: the only difference being the substitution of two truncated parabolic conoids for the paraboloid, and a refracting belt for the lens. Two of these instruments directed to opposite points of the compass would light up the whole horizon.

Another new form of lighthouse apparatus was also described, by which the whole sphere of rays can be parallelized by means of a hemispherical reflector placed behind the light, and an annular lens, and a series of concentric totally-reflecting glass zones, also placed in front, and receding from the lens back to the reflector. These zones are also new in themselves, as they have the property of parallelizing divergent rays, not only in a vertical plane, like the zones in Fresnel's fixed lights, but also in every plane whatever.—*Proc. Roy. Scot. Soc. Arts.*

Extracts from the Annual Report of the Board of Canal Commissioners of Pennsylvania, for the fiscal year ending Nov. 30, 1849.

The Board of Canal Commissioners submit the following report of the operations on the several lines of canal and railroad of the Commonwealth, for the year ending the 30th of November, 1849.

The receipts and expenditures were as follow:—

RECEIPTS.

For motive power charges, and for the use of State trucks on the Philadelphia and Columbia railroad, including fines and old materials sold, ...	$291,759·36	
For tolls on the Philadelphia and Columbia RR.	290,991·01	
		$582,750·37
For motive power charges, and for use of State trucks on the Allegheny Portage railroad, including fines and old materials sold,	166,453·93	
For tolls on the Allegheny Portage railroad,	54,012·63	
		220,466·56
For tolls on main line of canal, including collections at outlet locks, bridges, and aqueducts; also, rents, fines, and old materials sold, ...		443,324·58
Carried forward, . .		1,246,541·51

Brought forward,		$1,246,541·51
Deduct drawbacks,		279·46
Total gross receipts on main line,		1,246,262·05
For tolls and fines on Delaware division,		196,714·24
For tolls, rents, and fines on the Susquehanna and North and West branches,		190,301·43
Total gross receipts on all the lines,		1,633,277·72

EXPENDITURES.

For maintaining motive power on the Philadelphia and Columbia railroad, including repairs and management of trucks, and purchase of two new engines from motive power fund,	$191,368·14	
For purchase of two new engines from special appropriation, per act of 10th April, 1849,	16,400·00	
For repairs of Philadelphia and Columbia RR.	76,771·14	
For collectors, weigh masters, inspectors, and incidental expenses of their offices,	10,316·58	
		294,855·86
For maintaining motive power on the Allegheny Portage railroad, including the repair and management of State trucks, and the purchase of two new boilers, two new engines, and two passenger cars,	171,029·15	
For repairs on Allegheny Portage railroad,	45,664·70	
For repairing damage by explosion at plane No. 10,	3,012·69	
For collectors, weigh-masters, inspectors, &c.,	2,956·57	
		222,663·11
For ordinary repairs and breaches on main line of canal,	111,878·67	
For collectors, weigh-masters, inspectors, &c.,	15,637·00	
For lock-keepers,	25,394·00	
		152,909·67
For repairs and breaches on Delaware division,	23,010·45	
For collectors, weigh-masters, inspectors, &c.,	4,014·78	
For lock-keepers,	5,492·97	
		32,518·20
For repairs on Susquehanna division,	6,768·11	
For repairs on West Branch division,	24,702·35	
For repairs on North Branch division,	13,000·00	
For collectors, weigh-masters, inspectors, &c.,	5,665·57	
For lock-keepers,	5,418·00	
		55,554·03
Total expenses,		758,500·87
Gross receipts,		1,633,277·72
Net receipts over expenses,		874,776·85

The pay of the Canal Commissioners, Secretary, Messenger, and incidental expenses of their office, amounting to 5179 dollars and 29 cents, and the cost of repairing farm and road bridges, under a special appropriation, amounting to 5000 dollars, are not included in the foregoing statement of expenditures. If these two sums be added to that account, the net revenue of the Commonwealth from the public works will be 864,597 dollars and 56 cents, being an increase over the net revenue of 1848, of 383,791 dollars and 10 cents. This increase is, in fact, much greater, if the large amount of debts not included in the reported expenditures for 1848 be added to the cost of repairs for that year. The increase in the gross receipts of tolls over 1848, is 79,933 dollars and 72 cents.

A more favorable result would have been obtained, but for the prevalence of the epidemic with which the various sections of the Union were visited during the year, and the extremely low water in the Western division of the canal, and in the Ohio river, which continued for near three months. The loss of revenue from these causes is estimated at 100,000 dollars. The diminution in the receipts from tolls, caused by the low water in the upper levels of the Western division, which would have been obviated by the completion of the reservoir on the western side of the Allegheny mountain, amounted to a much larger sum than the cost of finishing that structure. For a more extended view of this evil, from which the transportation business and the public revenues have been suffering for years, the Legislature is respectfully referred to the remarks under the proper head.

As has been before stated, the expenditures for all purposes for the year 1849, were 758,500 dollars and 87 cents. It is proper, however, to observe that, in this sum, is included 52,500 dollars, paid for six new locomotive engines, two passenger cars, and a new weigh scale at Philadelphia. These expenditures have been usually considered as additions to the permanent stock of the railroads, and not properly chargeable to the expenses of the year in which they were purchased. If these items had been deducted the present year, it would have made the expenditures 706,000 dollars and 87 cents, and the net receipts 927,276 dollars and 85 cents.

Every effort has been made, and the Board believe with success, to include in the foregoing table of expenditures every dollar of cost, whether paid or unpaid, for all the various branches of the service, so as to prevent the expenditures of one year being mixed up with those of the next. It will be seen from that table that the cost of repairs of the canals and railroads for the fiscal year amounted to 304,795 dollars and 42 cents, being an excess over the aggregate appropriation made by the Act of the 10th of April last, of 18,395 dollars and 42 cents. In this amount, however, is included the sum of 6599 dollars and 7 cents, for breaches and other casualties. The amount of indebtedness for repairs for the year, beyond the appropriation, and which is included in the table of expenditures, is 25,203 dollars. The apparent discrepancy between this sum and the excess of the cost of repairs over the estimates, is accounted for by the fact that the specific appropriations for several of the divisions were more than sufficient, and that these balances revert to the Treasury proper.

Statement showing the Comparative Cost of Running First and Second Class Locomotives on the Philadelphia and Columbia Railway.

One first class locomotive will haul, with ease, thirty-five cars at the following cost:

Cost of locomotive, $8200—10 per cent. wear and tear,	$820·00	
" " 6 " interest,	492·00	
	1312·00	
per annum, or at three hundred and ten working days,		$4·23 per day.
Engineer $2 per day, fireman $1·25,		3·25 "
Sperm oil, four pints, at $1·20 per gallon,		60 "
Rags, three pounds, at five cents per pound,		15 "
Wood, two and seven-eighths cords, at $3 per cord,		8·62 "
Cost of locomotive per day, hauling thirty-five cars, at 48¼ cents per car,		16·85

One second class locomotive will haul only twenty cars, and will cost as follows:

Cost of locomotive $7000—10 per cent. wear and tear,	$700·00	
" " 6 " interest,	420·00	
	1120·00	
per annum, or at three hundred and ten working days,		$3·62 per day.
Engineer $2, fireman $1·25 per day,		3·25 "
Sperm oil, three pints, at $1·20 per gallon,		45 "
Rags, two pounds, at five cents per pound,		10 "
Wood, two and one-half cords, at $3 per cord,		7·50 "
Cost of locomotive per day, hauling twenty cars, or 74⅔ cents per car,		14·92
120,000 cars per annum, carried in trains of 35 cars each would give		3428$\frac{20}{35}$ trips.
Same number of cars, hauled in trains of 20 cars each, would give		6000 "
Saving,		2571$\frac{15}{35}$ "
2571$\frac{15}{35}$ trips per annum, at $16·85 each, would be		$57,771·43
6000 " " 15·00 " "		90,000·00
Saving,		32,228·57

In pursuance of the act of the 10th April, 1849, entitled "An Act to provide for the ordinary expenses of government," &c., the Board, on the

24th of May last, appointed Edward F. Gay, Esq., engineer, to survey a route for a railway to avoid the Schuylkill inclined plane, and to report whether such a road could be constructed within the restrictions of the appropriations and grades prescribed by said act. The result of the survey being entirely satisfactory to the Board, the Executive was informed by them that the road could be completed within the terms of the act of the Legislature. Upon official information being received from that department, that the loan had been taken, proposals were immediately invited, and the grading and masonry allotted in the early part of August last, at prices much below the estimate of the engineer. The grading is progressing as fast as is desired, and it is contemplated that the entire road will be completed for use by the first of July next. By the accompanying report of the engineer, it will be seen that this road commences "near the ninth mile post on the Columbia railway, and about two miles east of Whitehall station. The line is located on the route and upon the bed of the old West Philadelphia railway as far as Hestonville, a distance of four and three-eighths miles; and thence, diverging from that road, it pursues nearly a direct course to the quarries at the west end of Fairmount dam; the line here curves gently to the right until it reaches the Blockley turnpike, or Haverford street, in Mantua village; and thence pursues a straight course, passing in the rear of Harding's hotel, and through Powelton, to a point near the borough line of West Philadelphia,—whence, curving on a radius of fifteen hundred feet, it passes through property belonging to the City of Philadelphia, and terminates at the west end of Market street bridge; distance from Hestonville three miles and sixteen chains, making the whole length of the road seven and five-eighths miles, nearly. The extension of the road to Broad street, a distance of seventy-four chains, and the construction of a bridge across the Schuylkill, has been undertaken by the city authorities, and are to be finished for use on or before the 15th day of July next. It is expected, however, that the work will be so far advanced towards completion as to allow the passage of cars by the 1st of July. The total distance by the new road, from its western terminus to Broad street, is eight and one-half miles, being fifty-six chains less than by the present route."

The following are the grades of the new road, commencing at its intersection with the old, viz:

	6 chains,	.	Level.	
2 miles and	16 "	. .	45 feet per mile.	
2 "	74 "	. .	50 "	"
	40 "	. .	23⅝ "	"
	70 "	. .	44 "	"
	40 "	. .	40 "	"
	20 "	. .	20 "	"
	20 "	. .	10 "	"

The total fall overcome is three hundred and twenty-six feet, equal to an average grade of about forty and eight-tenths feet per mile.

The following is the engineer's estimate of the cost of the road, "predicated chiefly on the contract prices, and in cases where the work is not

under contract, allowances having been made sufficient to ensure its completion," viz:

Grading and masonry, . .	$147,195
Double tracks and sideings, . .	152,700
Depôt, collector's office, weigh-scales, &c., .	30,000
Damages, fencing, and roads, . .	27,000
	356,895
Contingent and unforeseen expenses, 5 per cent.,	17,844
Total, . . .	374,739

If this estimate prove correct, and it is believed to have been made up with much care, there will be a surplus left of about twenty-five thousand dollars, which the Board, in a former part of this report, recommend to be appropriated, with other funds, to the improvement of the Columbia railroad.

A contract for the iron rail of this new road has been entered into with the proprietors of the Montour and Phœnixville rolling mills. It is to weigh sixty pounds to the yard, and is to be delivered at either terminus, at fifty dollars per ton. The Board, after due deliberation, felt satisfied that this contract, even in an economical point of view, was the best that could be made for the interests of the State. It is believed that the quality of the iron manufactured at these establishments will render its use cheaper in the end than that recently imported from foreign countries at a less price per ton.

AMERICAN PATENTS.

List of American Patents which issued in the Month of June, 1849, *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner in the U. S. Patent Office.*

1. For an *Improvement in Brakes for Carriages;* Gideon Griest, Adams county, Pennsylvania, June 5.

The patentee says,—"My improvement relates to a combination of levers and rods, connected with the hounds and futchels, sliding rubber bar, and sliding bar, and stops, for the purpose of changing the position of the fulcra of the levers attached to the rubber bar, as the rubbers wear, in order to keep the rubbers at an uniform distance from the peripheries of the wheels. Also, in attaching the sway bar bolt to the sliding rod, and making an oblong opening or slot of sufficient length, in the ordinary tongue, to allow it to play back and forth, simultaneously with the forward and back movements of the rubbers, for preventing the sway bar striking the horses during the operation of the retarding apparatus, and the sudden advance of the carriage or wagon. And also, for throwing back the rubbers from the wheels, by the forward movement of the horses drawing forward the sway bar, and the sliding rod attached thereto, causing the levers to be reversed.

Likewise, in attaching to the tongue an apparatus for locking the sliding rod to it, so as to prevent the action of the retarding apparatus at pleasure."

Claim.—"What I claim as my invention, is, 1st, the combination of the levers P P with the levers L L, rods, bar, sliding rod, and rubbers, arranged and operated substantially as above described, and for the purpose set forth."

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2. For *Improvements in Cockeyes for Harness;* Fowler P. Taylor, assignee of Joseph W. Briggs, Cleveland, Ohio, June 5.

Claim.—"What I claim as new, is the combination of the loop of the trace with a sectional cross-piece and a cockeye, whereby the trace is secured to a swivel cockeye without impairing its stength, and all the metallic parts are adapted to being made of cast metal."

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3. For an *Improvement in Extension Machines for Raising Bricks, Mortar, &c.;* Jacob and John Pringle, Cambria county, assignees of James Cox, Ebensburgh, Cambria county, Pennsylvania, June 5.

Claim.—"I claim combining the two series of extension frames, substantially as described, so that one may act as a counterpoise to the other when in use, and that, when out of use, the two frames may be brought down upon a level, for convenience of transportation, and occupy but little room; and also, that the relative height of the series may be adjusted for the purpose and in the manner described, or by any analogous mechanical devices."

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4. For an *Improvement in Making Ivory Fine Tooth Combs;* Fenner Bush and Julius H. Pratt, Meriden, New Haven county, Connecticut, June 5.

Claim.—"What we claim as our invention, is the constructing a comb of four pieces of ivory or other material, united substantially in the manner set forth, to wit, two comb plates, having their inner edges bevelled off and joined to each other by means of the two strips placed opposite to each other, over the bevelled edges of the plates, and connected by a row of rivets passing through the centres of the strips, and through the bevelled edge of each comb plate, as described."

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5. For an *Improved Railroad Turnout;* Carlton Dutton, Rochester, New York, June 5.

Claim.—"What I claim as my invention, is the combination of the switch rails with the frog latch, in such a manner that the frog latch is forced to move simultaneously with the switch rails, by means of a series of rods and levers, arranged and connected as described."

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6. For an *Improvement in Bee Hives;* Arza Gilmore, Wayne, Kennebeck county, Maine, June 5.

Claim.—"What I claim as my invention, is the employment of the slide door, in combination with the open galleries above and below the same,

for the purpose of separating or combining, at the will of the apiary, the several tiers of chambers as described and represented. I also claim the use of the dark chamber, with the passage out of the same through the main body of the working hives, for the purpose of domesticating wild or foreign bees, by compelling them, in leaving the dark chamber, to pass through or into the working chambers of the bee house."

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7. For an *Improved Trap, and Method of Setting it;* Thomas A. Davis, City of New York, June 5.

Claim.—"What I claim as my invention, is the combination of the hook, the straight bar to which it is attached by a pivot, and the spring; the whole arranged and acting as described, by which I am enabled to set the trap without a catch or lock of any kind."

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8. For *Improved Tent Frames;* Jesse E. Dow, Washington City, D. C., June 5.

The patentee says,—"The nature of my invention consists in constructing a tent without a centre pole, or any ropes, pins, or other similar device, by which the whole interior of the tent is free, and the tent can be pitched or struck in much less time than the ordinary one, while it is capable of standing in any soil with greater security, is impervious to water, and is perfectly ventilated."

Claim.—"What I claim as new, is the constructing a tent substantially in the manner described, with a series of poles jointed together at the centre, and having spade-formed feet, by which it is anchored to the ground without pins and other fastenings, as set forth."

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9. For an *Improvement in Grain Drills;* Edward Steacy, Strasburgh, Lancaster county, Pennsylvania, June 5.

Claim.—"What I claim as my invention, is shifting the hoppers back and forward with couplings and levers, as set forth, to continue or stop the seeding, in combination with the shaker, having movable dies therein, for regulating the quantity of seed and distributing the same, and moved as described."

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10. For an *Improvement in Windmills;* Charles B. Hutchinson, Waterloo, Seneca county, New York, June 5.

The patentee says,—"The nature of my invention and improvement consists in securing to a vertical shaft, arranged within a suitable frame, and resting on a step at the lower part of the same, a series of radial arms, curved near their outer extremities, where they are secured to a ring or rim, and having vertical shafts fastened to their curved parts, provided with pulleys above and below, around which pass bands or cords extending over similar pulleys attached to the main revolving shaft, and fastened at each end to a rising and falling button or ring, connected by a rod to a similar ring or button near the lower part of the shaft, within reach of the operator; said cords or bands being also attached to other bands or cords

passing over pulleys at the upper ends of the rods, and secured to the upper end of triangular sails at one end, and wound round a series of vibrating rollers at the other; and also in providing the wheel with a governor; the whole being constructed, arranged, and operated in such a manner as to cause the wind to act on all the sails more or less at one and the same time, and to regulate the speed of the wheel without the assistance of the operator, and to enable him to lower the sails from below, and thus stop the motion of the wheel when desired."

Claim.—"What I claim as my invention, is the combination of the curved bars, connected to the radial arms by hinged plates or bars, connecting bars, hubs, connected together by a rod, forked lever and governor, for regulating the speed of the wheel, in the manner described.

"I likewise claim the mode of raising and lowering the sails, when desired, by means of the bands or cords L, attached to the hub K, connected to the hub *r*, below, by the rod *s*, passing over the pulleys *t u v w*, and attached in their course, at the point *x*, to the cords *p*, passing over the pulleys *g*, and secured to the peaks of the sails, and the worm or screw pulleys *d*, on the rollers D, as set forth."

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11. For an *Improvement in Parlor Cooking Stoves;* Edward R. Brown, Albany, New York, June 5.

Claim.—"I claim the employment of a double top plate, constructed as described, the upper part of which is whole and is removable at pleasure, while the lower portion is furnished with apertures for boiler holes, which are covered with ordinary covers, as set forth, both parts of the double top being made the full size of the stove."

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12. For an *Improvement in Pumps;* Downs, Mynderse & Co., assignees of Birdsill Holly, Seneca Falls, Seneca county, New York, June 5.

Claim.—"What I claim as my invention, is the combination of the nozzle with the pump barrel, in such a manner that the nozzle can be readily changed from side to side, and secured in any desired position, substantially as described and represented."

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13. For an *Improvement in Corn Ploughs;* Stephen Coats, La Fayette, Walworth county, Wisconsin, June 5.

Claim.—"What I claim as my invention, is the auxiliary cultivator teeth in the outer ends of the drag, as described."

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14. For an *Improvement in Metallic Alloys;* Herman B. Babcock, City of New York, June 5.

Claim.—"What I claim as my invention and discovery, is the composition, as described, composed of zinc and iron, combined with each other when in a fused state, and the application and use of said composition to the purposes specified, and to any other useful purpose to which it may be applied."

15. For an *Improvement in the Consumption of Fuel in Steam Boiler and other Furnaces;* Christian Burckhardt, Cincinnati, Ohio, June 5.

The patentee says,—"The nature of my invention consists in applying decomposed steam, at a high temperature, to the products of combustion above the coal or other fuel, together with a due proportion of atmospheric air, the whole of which commingle, and by which all the combustible matter in the fuel is consumed."

Claim.—"What I claim as new, is the employment, arrangement, and combination of apparatus, constructed substantially as described, for consuming the gases arising from ignited fuel, by the introduction of decomposed steam, or the gases resulting therefrom, and atmospheric air in a highly heated state, over fire. I also claim the revolving grate, constructed and operating as described."

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16. For an *Improvement in Seed Planters;* James D. Willoughby, Chambersburg, Franklin county, Pennsylvania, June 5.

Claim.—"What I claim as new, is, 1st, the manner of guiding the machine by changing the position of the tongue, substantially in the manner set forth.

"2d, The combination, substantially as described, of the lever and link with the beam and tooth, for the purpose of drawing back the point of the tooth at the same time the beam is raised, whereby the tooth is easily kept clear of sods, roots, and other obstructions, and the danger of its getting broken diminished."

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17. For an *Improvement in Smut Machines;* Joseph Hëygel, Cumberland, Alleghany county, Maryland, June 5.

The patentee says,—"The nature of my improvement consists in the combination of two rubbing surfaces of India rubber, and rubbing surface of India rubber with cast iron, to clean the wheat from smut and garlic."

Claim.—"What I claim as new, is the combination with each other of the inclined and horizontal runners, and constructed substantially as set forth, for the purpose of more perfectly separating smut and garlic from wheat."

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18. For an *Improvement in Sun Dials;* James Scott, Portland, Cumberland county, Maine, June 5.

The patentee says,—"My invention consists in combining with the gnomon a small pin wire or shadow indicator, and a scale, to indicate, by means of the shadow of such a pin or indicator, the month and day of the month; whereby the dial may not only be made to indicate the time of the day, but also the day of the year: that is to say the month and day of the month."

Claim.—"What I claim as my invention, is the shadow indicator or pin, and declination scale, or scale of months and days, in combination with the gnomon, substantially in the manner and for the purpose as specified."

19. For an *Improved Steering Apparatus;* Jesse Reed, Marshfield, Plymouth county, Massachusetts, June 5.

The patentee says,—"The essential and distinguishing feature of my newly invented steering wheel is a revolving right and left-threaded screw, working two half nuts on opposite sides of said screw, said nuts being connected to the two sides of the rudder head; and as the nuts move always in opposite directions, on opposite sides of said revolving screw, they both tend to give the rudder a rotary motion in the same direction."

Claim.—"What I claim as my invention, is the combination of a right and left-threaded screw, on the hand wheel shaft, with two half nuts, arranged one on each side of said screw, and traversing in guides opposite to each other, as herein above set forth, said nuts being connected to the rudder head, either by the long arms, as in the first described arrangement, or as in the second, by the slotted arms and sliding buttons, all arranged and operating substantially as set forth."

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20. For an *Improvement in Subsoil Corn Ploughs;* Henry Bacon, Tecumseh, Lenawee county, Michigan, June 5.

Claim.—"What I claim as my invention, is the construction of my subsoil plough shares, in combination with the small ploughs fastened above them on the same standards, and having a space between them, in the manner and for the purpose described."

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21. For an *Improved Shank Painter-Stopper;* Charles Perley and Joshua Terry, City of New York, June 5.

Claim.—"We claim as new and of our invention, the application, arrangement, and combination of the parts described and shown, by which the lock piece, with ears or shoulders, places any ultimate strain upon the fixed fillets, and, through the lug and pin, secures all the operative parts from moving by accidental causes, at the same time providing means, through the attached chain, by which one man can release or 'let go' the anchor without other manual help, and without other mechanical aid than that furnished by the parts attached and employed, when constructed and combined substantially in the manner described."

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22. For *Chills for Casting Rasps, Files, &c.;* Ezra Ripley, Troy, Rensselaer county, New York, June 5.

The patentee says,—"The nature of my invention consists in constructing the die of strips of metal, in such a manner as to ventilate the die and mould, so as to allow the metal to run freely and fill the teeth to a degree of point and sharpness not heretofore attained in casting iron."

Claim.—"What I claim as my invention, is the method described of casting floats, rasps, graters, &c., by means of a series of chill dies, constructed and used as herein described, the essential in the construction of such chills being that there is one piece for every series of teeth, and that the latter are cast in indentations formed between the chills, the same being formed substantially in the manner and for the purpose set forth."

23. For an *Improvement in Cultivators;* George W. Brown, Tylersville, Warren county, Illinois, June 5.

The patentee says,—"The nature of my invention and improvement consists in so arranging the several parts of the cultivator that the shovels can be extended or closed, for the purpose of ploughing between wide and narrow rows, or adjusted in regard to their angle of inclination, so as to throw the earth towards or from the rows at pleasure, by simply moving two short side adjustive beams to which the shovels are affixed, which is effected by means of a combination of levers and connecting links."

Claim.—"What I claim as my invention, is the mode of adjusting the position of the shovels, so as to throw the earth from or towards the rows of corn, or to the right or left at pleasure, by means of the before described combination of the levers, links, and adjustive bars, with the parallel slotted bars and oblique hinged bars, as described."

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24. For an *Improvement in Shoulder Braces;* Samuel S. Fitch, City of New York, June 5.

Claim.—"What is claimed as my invention, is the employment of the metallic coiled spring, with one or more coils, in combination with shoulder straps, with or without eyelet holes and lace, tugs, and pads, substantially as and for the purposes described."

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25. For *Machinery for Operating Railroad Gates by Means of the Locomotive;* Richard Coffin, West Haverhill, Essex county, Massachusetts, June 5.

The patentee says,—"The nature of my invention consists in constructing and arranging a gate, and the operating apparatus in connexion therewith, designed to close up the common road at the time the engine or train crosses it, and which shall open and shut of itself, through the action of the locomotive, when it passes by the crossing of a common road where the said gate is erected."

Claim.—"I claim the vibrating cam levers attached to the bars, in combination with the cam block and the spring L, and the rope or chain passing over the pulley, and the spring K, for the purpose of opening and closing the gate by the action of the projecting bar of the locomotive upon the vibrating levers, in the manner substantially as described."

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26. For an *Improved Gun Lock;* William W. Marston, City of New York, June 5.

The patentee says,—"The nature of my invention consists in giving to the fulcrum of the trigger an adjustable facility, by which the seer of the same may retract or return to its position back of the arm, answering to the tumbler after having been operated, independent and without the use of the ordinary intervening trigger catch or dog, common to most of gun locks."

Claim.—"What I claim as new, is the adjustable slot in the centre hole and fulcrum of the trigger, acting in direct combination with the spring D,

and also in combination with the arm of the hammer and the main spring, substantially as described."

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27. For *Improvements in the Boom Derrick;* George E. Warner, Springfield, Hampden county, Massachusetts, June 5.

The patentee says,—"The nature of my invention consists of a combination and arrangement of machinery for raising bricks, mortar, and other building materials for buildings in the process of erection, whereby is effected a great economy of time and labor in the operation, as compared with the ordinary modes of performing the work."

Claim.—"What I claim as new, is the drum, as constructed with its inner shaft, with its arrangement for giving independent motion, by means of which the ropes can be housed and protected, in combination with the adjustable rotary cross beam, arranged and operated as described, by means of which combination and arrangement I am enabled to have in wear only such portions of the ropes as the operation of the machine and the varying elevation of the wall or structure may demand."

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28. For an *Improvement in Seed Planters;* David Deihl, Hanover, York county, Pennsylvania, June 12.

Claim.—"What I claim as my invention and improvement, is, 1st, the combination of the roller, springs, and lever, with the rack to which the cultivator teeth are affixed, for regulating the depth of furrowing in various kinds of hard or mellow soil, without the necessity of altering the position of the transverse beams to which the rear ends of the parallel longitudinal beams are connected.

"2d, I also claim the manner of preventing the seed passing from the hopper through the channels of the planting cylinder, when the cultivator teeth are raised from the ground, or whenever it is desired to stop the planting operation, by means of the combination of the transverse rising and falling bar, cams, bent rods, sliding bar, valve rods, and springs, with the frame, as described.

"3d, I likewise claim placing the radial pins in the channels of the planting cylinders, in the manner and for the purpose set forth."

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29. For an *Improvement in Harvesters;* Nelson Platt, Ottawa, Lasalle county, Illinois, June 12.

Claim.—"What I claim as my invention, is the combination of a series of removable cutters with the links of an endless revolving chain, which carries them successively into contact with the grass or grain to be cut, substantially as described, whether the cutters be contiguous or placed at intervals upon the chain.

"I also claim making one end of each cutter sharp, in order that, by pressing against the adjacent end of the next cutter, straw, grass, or other intervening obstructions, may be cut in two and pass out, the cutters thus freeing themselves from obstructions which might otherwise choke or break them.

"I also claim placing the bundles or sheaves of grain at right angles to

the path of the machine, by means of a second rake combined with the first, substantially as herein set forth.

"I also claim moving or turning the first rake by cords, chains, or belts, arranged and operated as described, or in any other substantially similar manner.

"I also claim vibrating the second rake and turning its teeth, as set forth, whether the devices employed to effect these movements be such as described, or others equivalent thereto.

"I also claim changing the frequency of the alternations of the rakes, by means of the cones of wheels and pinions, or other equivalent device, for the purpose of varying the size of the sheaves, as set forth."

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30. For an *Improvement in Harness Saddles;* Joseph W. Briggs, Cleveland, Ohio, June 12.

Claim.—"What I claim as new, is disconnecting the pads from the skirt and girth, when the pads are hinged to, and placed far enough beneath, the tree to admit of free motion to conform to the shape and changing positions of the horse's back, without coming into contact with the skirts or girth which are attached to the tree, as set forth."

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31. For an *Improvement in Steam Pipes for Sugar Boiling;* Alfred Stillman, City of New York, June 12.

Claim.—"What I claim as my invention, is connecting the two compartments of the main steam pipe of the evaporating tubes of evaporating pans, by means of a series of syphon tubes, which receive the steam from one compartment and discharge it into the lower compartment, whereby I am enabled to obtain a larger amount of heating surface than by any other known plan."

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32. For an *Improvement in Drill Barrows;* George Colby, Fayetteville, Franklin county, Pennsylvania, June 12.

The patentee says,—"My invention consists in a peculiar arrangement of adjustable cams, to regulate the frequency with which the seed is deposited, and in giving to a combined slide and agitator, which admits the seed from the hopper into the discharger, a double motion, whereby the discharge of the seed is rendered more regular and certain."

Claim.—"What I claim as my invention, is the combination of the upper slide with the lower, the former moving at least twice for one movement of the latter; the two being made and arranged in the manner and for the purpose as set forth."

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33. For *Improvements in Machines for Cutting Out Felloes;* Joseph and Levi Adams, Hadley, Hampshire county, and Luther H. Moore, Leverett, Franklin county, Massachusetts, June 12.

The patentees say,—The nature of this invention and improvement consists in securing to the upper end of a vertical shaft, turning in boxes in a suitable frame, a horizontal beam having adjustable cutters attached

near its extremities, at the required relative distance from the centre of the shaft to correspond with the inner and outer curvature of the felloe to be cut, and causing said cutters to revolve over the timber from which the felloes are to be cut, and gradually descend during their revolutions, by means of bands, pulleys, friction wheels, screw shaft, levers, &c., and cut the felloe, and, by means of the movement of a lever, to reverse the movement of the screw shaft, and cause the cutters to ascend to their original positions, to allow the operator to bring the timber forward for another cut."

Claim.—"What we claim as our invention, is the combination of the cutter head and beam with the levers G *j;* cross head moving between upright slides, and attached to the lever *j* by the connecting rod, iron straps, and oblong plate; screw shaft passing through the cross head, and provided with the friction wheel *o*, which is alternately thrown into gear with the friction wheels *f p*, on the upper ends of the shafts, by means of the horizontal beam, pulleys, and weights, and lever *w*, for elevating and depressing the cutter beam and cutters, in the manner and for the purposes herein set forth."

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34. For an *Improved Pad Lock;* Francis C. Goffin and Conrad Liebrich, Philadelphia, Pennsylvania, June 12.

Claim.—"What we claim as our invention, is the main spring answering three distinct purposes, viz., throwing out the bow, holding back the bolt proper when unlocked, and forcing it forward in locking, its power increasing during the process of locking and unlocking, while it is perfectly at ease when unlocked; all of which is constructed and operates substantially in the manner herein above described."

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35. For *Improvements in Barrel Machinery;* Reuben Murdock, Rochester, Monroe county, New York, June 12.

The patentee says,—"The object of my improved machinery is the production of a smooth stave, having both its cross and longitudinal sections correctly curved, and the edges correctly beveled and jointed, so as to fit it for the hoops."

Claim.—"What I claim as my invention, is, 1st, the combination of the revolving dogs, the pawls, the disengaging levers, the vibrating feed lever, and the stops, whereby the slab is secured on the carriage, and successive staves sawed from the same slab.

"2d, I claim disconnecting the carriage from the feed gear, during its retrograde motion, while the slab is being fed towards the saw, substantially in the manner and for the purpose set forth.

"3d, I likewise claim the combination of the oscillating saw, with the curved gated case, whereby the stave is securely held during the action of the saw, in the manner and for the purpose set forth.

"4th, I likewise claim the combination of the stave carriage with the spring dogs and spring holdfast and stop, whereby the stave is securely held down during the action of the saws, and then thrown from the machine.

"5th. I also claim the combination of the concave and convex pressure feed rollers, and the self-adjusting spring clamps or rests, with the concave and convex cutters, when the several members are arranged in the curve of the longitudinal section of the stave, as set forth."

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36. For *Improvements in Trucks for Railroad Cars;* Isaac Knight, Baltimore, Maryland, June 12.

The patentee says,—"The object of my invention is to dispense as much as possible with the conical form of the wheels, and at the same time to enable the cars to pass around the curves of the road with less friction and loss of power than upon any plan heretofore used or known; and also to enable cars of great capacity to be built upon a plan much more simple, cheap, and safe than heretofore."

Claim.—"What I claim, is the connecting and combining, in the carriage for carrying burthens and passengers upon railroads, one or more intermediate pair of cylindrical wheels, or wheels nearly cylindrical, without flanches, loose upon their axles, or otherwise independent in their action, so that any one of these intermediate wheels may revolve faster or slower than the others, in connexion with guide wheels having one or two flanches, they being made fast to their axles; and also, either for a six or eight wheel car, all the wheels of the same carriage, both fast and loose on their axles, being attached to one and the same stiff frame by means of springs and bearing boxes, or otherwise. This combination in a railroad carriage, as above described, I claim as new and of my own invention; I do not, however, claim cylindrical wheels on separate frames, made fast to, and revolving with, their axles, these having been used in steam locomotive engines as drivers, but I do claim the loose or independent wheels without flanches, in connexion with guide wheels having flanches, and the attachment of the wheel to the one stiff frame, as above described."

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37. For an *Improved Construction of the Master Wheel of Horse Powers;* John A. Taplin, Fishkill, Dutchess county, New York, June 12.

The patentee says,—"The nature of my invention consists in giving the segments of the master wheel an I cross section, the segments having greater depth than width, and having vertical cog teeth cast to their lower edges; and in connecting together the segments thus formed by two segmental rings of wrought iron, which are inserted in the opposite depressed sides of the cog segments. The segmental rings break joint with each other, and with the joints of the cog segments, and are secured to each other, and to the cog segments, by screw bolts passing transversely through the rim; the several parts, when combined, forming a rigid annular wheel, which will maintain its shape without the use of framing."

Claim.—"What I claim as my invention, is making the rim of the master wheel of a horse power, within which the horse walks, of annular segments of cast iron, (the cogs being vertical and on the edge of the segment,) the inner and outer peripheries of which are grooved, and have segmental bands of wrought iron fitted therein, the wrought iron segments breaking joint with each other, and with the cogged segments, and the whole being

bound together by through bolts, thus making a portable rim wheel, sufficiently strong and rigid to maintain its form and perform its duty without the assistance of framing."

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38. For an *Improvement in Corn Shellers;* Jacob Mumma, Middletown, Dauphin county, Pennsylvania, June 12.

The patentee says,—"The nature of my improvements consists principally in the peculiar formation of the runner, and its adaptation to the stationary breast beam, with spring blocks thereon, by which I am enabled to shell corn with greater facility and less labor than in the ordinary way; the peculiarity of the arrangement consists in so placing the inclined breast beam in juxtaposition with the runner, as to make every part of the straight line of the beam to approach the curved face of the runner at nearly the same distance at all points; the angular form of the rows of teeth, and the peculiar form of the runner, cause the corn to be raked off from end to end of the cob, which is supported on the permanent breast beam, and is caused to pass out of the machine with increased rapidity as it is shelled."

Claim.—"What I claim as new, is the employment of a concave runner, by means of which the cobs are more freely discharged, armed with spiral rows of teeth or ribs, combined with the inclined breast beam and spring block, substantially in the manner and for the purpose set forth."

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39. For an *Improvement in Churns;* Chapman Warner, Louisville, Jefferson county, Kentucky, June 12.

Claim.—"What I claim as new, is making the moving parts of the churn, consisting of a vertical shaft and rotary dasher, constructed substantially as specified, to be suspended and combined with the movable lid, as described, thereby dispensing with a pivot or step at the lower end of the shaft for the purpose set forth, so that said moving parts can be readily lifted from the churn and again be replaced; the whole operating in the manner described."

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40. For an *Improvement in Musical Notation;* Ernest Von Heeringen, Pickensville, Pickens county, Alabama, June 12.

The patentee says,—"The first portion of my improvement is designed to enable beginners to acquire the fingering of any keyed instrument without numbering the notes on the score, as is usually done.

"The second portion of my improvement is in the method of counting the musical intervals or notes, taking the chromatic scale instead of the diatonic for my base.

"In the third portion of my improved method of notation, the exact sound of the note, whether sharp, flat, or natural, is shown by the musical characters themselves, without the assistance of chromatic signatures."

Claim.—"What I claim as new, is, 1st, the arrangement of distinct characters, to denote the fingering of music, made and arranged substantially in the manner described.

"2d, Giving the twelve musical intervals distinct names, so that the use

of the words flat and sharp are entirely avoided, and with them, all the confusion naturally arising in the mind of a beginner.

"3d, Representing the sounds usually called natural by one uniform color, and those commonly called flats and sharps by another uniform color, so that they may be distinguished from each other by a mere inspection of the musical character representing the note, without the use of chromatic signatures."

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41. For an *Improvement in Inhalers or Lung Protectors;* Lewis P. Haslett, Louisville, Jefferson county, Kentucky, June 12.

Claim.—"What I claim as my invention, is, 1st, the nose or mouth joint, having the piece made to fit the nostrils or the mouth, in combination with the valves, for the purpose of causing the air to enter and be discharged through separate orifices, as herein described.

"2d, In combination with said nose or mouth joint and valves, I claim the filterer, either with or without the tube, as described."

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42. For an *Improvement in Cooking Stoves;* Jordan L. Mott, City of New York, June 12.

Claim.—"What I claim as my invention, is the method, substantially as described, of equalizing the heat in the oven, by combining with the diving flue at the back, and the series of tubular flues at the bottom with spaces between them, the return flue below the flue tubes and the return flue at the back of the diving flue, substantially as described.

"And I also claim the method of protecting the top plate of the stove, or the parts thereof, by lining it or them with a perforated plate or plates, with some earthy cement or other refractory substance interposed between the plate or plates and the perforated lining, as described."

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43. For an *Improvement in Reed Musical Instruments;* B. F. Blodget and H. B. Horton, Akron, Summit county, Ohio, June 19.

The patentees say,—"The nature of our invention consists in converting the wind chest, in which the reeds are located, into a sounding chamber, by forming one side of the wind chests of a thin elastic sounding board, placed in near proximity to the reeds."

Claim.—"What we claim as our invention, is the converting the wind chest, in which the reeds are located, into an expansible sounding chamber, by forming one side of it (the said wind chest) of a thin elastic sounding board placed in sufficiently near proximity to the reeds; when this arrangment is combined with the location of the valves on the outside of the wind chest or sounding chamber, substantially in the manner and for the purpose set forth."

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44. For *Improvements in Washing Machines;* Daniel L. Walker, Roxbury, Delaware county, New York, June 19.

Claim.—"I claim as my invention, the combination and arrangement of the front part of the box with its vertical flutings, and of the vibrating

fluted roller and pounders, for the purpose of turning the clothes with the supports, as described."

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45. For an *Improved Sculling Propeller;* Alexander Bond, Philadelphia, Pennsylvania, June 19.

Claim.—"What I claim as my invention, is the propeller suspended by, and in combination with, the shafts *a a*, the levers, and the shafts *c c*, constructed and moving substantially in the manner described and for the purpose set forth."

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46. For an *Improvement in Cooking Stoves;* Ebenezer F. Martin, Rockport, Essex county, Massachusetts, June 19.

Claim.—"What I claim as my invention, is the combination of the oven with the air space and fire chamber by means of the sliding doors, as specified, the same being for the purpose of either enabling a person to make use of the oven either for baking or roasting, as specified, or to make use of it for baking, while the roasting is done in a roasting apparatus set up against the opening, as explained."

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47. For an *Improved Gold Washer;* William Ball, Chicopee, Hampden county, Massachusetts, June 19.

Claim.—"I claim, in combination with the mercury bath, a surrounding channel or groove, made to communicate therewith by a passage, and applied so as to intercept the mercury which may be thrown out from the bath, whereby the mercury thrown out is again returned to the central cistern without intervention on the part of the operator.

"And, in combination with the elements above claimed, I claim one or more concentric mercurial rings, arranged between it and the cistern or bath, the same not being made to communicate with the main vessel or bath by any passage; the same being for the purpose of intercepting the small escaped particles of mercury, and retaining them until so washed by the water that they will coalesce with the mercury contained in said ring or rings.

"And I claim the central tube, as well as its perforated water diffusor or tunnel, in combination with the main hollow shaft, its bell-mouth vessel or top, and perforated partition or separator; the whole being made to diffuse and apply the water to the auriferous earth and mercury bath, and prevent packing of it within the tube, essentially as specified."

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48. For an *Improvement in Grain Drills;* Aaron Palmer, Brockport, Monroe county, New York, June 19.

Claim.—"What I claim as my invention, is the manner of connecting the planting tubes to the axle and seed box, substantially as represented and described, by which the person following after and attending the machine, is at all times enabled to witness its operation, and see that each tube deposits its proper quantity of grain or seeds in the drills, to wit: making use of pairs of parallel inclined bars, connected by hinge joints to

the tubes, and to the axle and seed box, with a groove formed in the lower bar of each pair, for conducting the grain or seeds from the seed box into the planting tube, to which it is jointed."

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49. For a *Rotating Tumbler Gun Lock;* Fred. Goodell, assignee of Thos. W. Harvey, City of New York, June 19.

Claim.—"What I claim as new, is the revolving tumbler, having a continuous rotating forward movement, by which the hammer is raised and allowed to escape through the intervention of a series of notches acting as cams on the arm of the hammer, substantially as described, and expressly as applied to gun locks. I also claim the said tumbler, as described and shown, in combination with the hammer, trigger, catch, and springs."

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50. For an *Improvement in Churns;* Geo. E. Gill and Jos. B. Tillinghast, Chilicothe, Ross county, Ohio, June 19.

The patentees say,—"The nature of our invention and improvement consists in a new combination and arrangement of known mechanical devices, whereby cream is churned by mixing a sufficient stream of atmospheric air with it, at the same time that it is subject to a high degree of agitation by a revolving dasher in the usual way."

Claim.—"What we claim as our improvement, is the introduction of double inclined stops, as described."

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51. For an *Improvement in Carding Machines;* John M'Carty, Somerset, Somerset county, Pennsylvania, June 19.

The patentee says,—"The nature of my improvements consists in the manner of banding the top rollers, thereby increasing their speed and regulating their motion, by which I economise power, and greatly increase the working effect of the carding machine."

Claim.—"What I claim as new, is banding the top rollers or workers to the main carding cylinder, substantially in the manner and for the purposes set forth."

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52. For an *Improvement in Carriers for Harvesting Machines;* J. J. & H. F. Mann, Clinton, Laport county, Indiana, June 19.

The patentees say,—"The nature of our invention consists in conveying the grain, after it is cut, from the reaping machine in bundles, in such a manner as to keep it straight, and discharge it from the machine without scattering, a difficulty heretofore found insurmountable by machinery, as, in all practical machines now employed, such as M'Cormick's and others, the grain has to be discharged by a rake by hand."

Claim.—"What we claim as new, is the employment, in combination, of a double series of endless bands, constructed and arranged substantially in the manner and for the purpose set forth, by which the grain is raked and carried over one side of the machine.

"And lastly, we claim the receiver, for collecting the grain into bundles and discharging it from the machine at once, in the manner made known."

53. For an *Improvement in Revolving Horizontal Coal Grates;* John F. Weishampel, Baltimore, Maryland, June 19.

Claim.—"All that I claim is, 1st, the combination and arrangement of the four segmental, hinged, and sliding doors, with the revolving grate, constructed, arranged, and operated in the manner and for the purpose set forth.

"2d, I claim the combination of the damper with the revolving grate, as described.

"3d, I claim the combination of the protuberance, on the inside of the case, with the case and doors of the grate, for closing the right hand doors as the grate is revolved.

"4th, I claim the combination of the double inclined plane with the case and the projections on the doors of the grate, for bolting the doors as the grate is turned.

"5th, I claim making the journals of the doors with shoulders on the upper and inner sides, by reducing the diameter of the journals, in the manner and for the purpose described."

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54. For an *Improvement in Seed Planters;* Edmund Myers, Union Mills, Carrol county, Maryland, June 19.

Claim.—"What I claim as new, is the combination of the teeth hinged on joint pins with the beams, and springs, substantially as described, whereby any of the teeth may turn aside, or rise over stones and other common obstructions which they may meet, thus greatly diminishing the danger of being broken, and of throwing the machine out of its track."

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55. For an *Improvement in Melodeons;* Charles Austin, Concord, Merrimack county, New Hampshire, June 19.

Claim.—"I claim my improved manner of arranging the reed with respect to the air passage or opening, as represented, and consisting in bending the thin end of the reed down below the bottom of the opening, substantially in manner, and so as to allow the air to operate on it, as explained."

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56. For an *Improvement in Atmospheric Churns;* Samuel P. Francisco, Reading, Berks county, Pennsylvania, June 19.

Claim.—"What I claim as my invention, is the tubulated disk dasher, surmounted by a hollow stem, for churning cream by agitating, and by admixing therewith the atmospheric air, and the gathering the butter (when separated) into large balls or rolls, as set forth."

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57. For an *Improvement in Winnowing Machines;* Benj. D. Saunders, Hollidayscove, Brooke county, Virginia, June 19.

The patentee says,—"The nature of this invention and improvement consists in conducting the grain through an inclined spout, and depositing the same on a sieve or screen enclosed in a vertical spout or trunk communicating with an ordinary fan, and, by producing a partial vacuum

above said grain, to cause the impurities to be drawn into the horizontal part of the trunk, where, by its superior gravity, it is caused to fall through an opening in the bottom of said horizontal part, while the chaff and dust, being too light to bear the draft of air, are drawn through the fan case, and discharged through the longitudinal trunk of the same to any point desired, thus effectually separating the two."

Claim.—"What I claim as my invention, is the trunk F, gradually enlarged from below upwards, and communicating with the atmospheric current through the screen, in combination with the hopper, and the fan placed at the end of the opposite vertical trunk D, to separate the chaff and other impurities from the grain, in the manner substantially as described."

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58. For an *Improvement in Self-Regulating Dampers for Stoves;* Benson Owen, Seneca Falls, Seneca county, New York, June 19.

The patentee says,—"The nature of my improvements consists in the application of the lateral motion produced by the expansion and contraction of a metallic plate or flexible rod, fastened at both ends to a permanent support, and having a lever, acting upon a register, combined therewith, so as to avail myself of the greatest amount of motion, caused by the expansion of said plate, to act on said register."

Claim.—"What I claim as new, is the employment of an expanding flexible plate, firmly secured at both ends, in combination with, and acting upon, a pendulum lever valve, regulating the draft, substantially in the manner and for the purpose set forth."

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59. For an *Improvement in Cooking Stoves;* Roswell Wilson, Albany, New York, June 19.

The patentee says,—"The nature of my invention consists in the arrangement of the plates, flues, and dampers of a cooking stove, in such a manner that the gaseous products of combustion may be conducted from the fire chamber to the smoke pipe by the various channels set forth."

Claim.—"What I claim as my invention, is the surrounding the oven with flue spaces, when the said flue spaces are arranged and combined with each other, and with the fire chamber and smoke pipe, by means of dampers, in the manner and for the purpose substantially as described."

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60. For an *Improved Lever to be placed on a railroad track, and acted upon by the wheels of cars or locomotives;* L. B. Kelly and B. Harper, assignees of John W. Hoffman, Philadelphia, Pennsylvania, June 19.

Claim.—"What I claim as my invention, is the joint lever, constructed and operated substantially as described, and applied on railroads, for the purpose of giving signals and regulating turnouts."

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61. For an *Improved Door Holder;* Edmund Morris, Burlington, Burlington county, New Jersey, June 19.

Claim.—"What I claim as my invention, is the method of constructing

turnbuckles or fastenings for shutters and doors of all kinds, by attaching a plug or knob to the back of the shutter or door, the same fitting or passing into the cavity of a cup-shaped vessel, through an aperture in a disk of India rubber or other elastic substance, the said rubber being so regulated as to grasp the knob, and keep the door or shutter back, substantially as described."

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62. For an *Improvement in Drying Grain;* Joseph H. Patten, City of New York, June 19.

Claim.—"What I claim as my invention, is the drying a mass of corn, or grain, or malt, or white lead, or flour, or meal, or similar substances, in a receptacle for the substance to be dried, having the air chamber placed within the receptacle, and under the mass or bulk of the corn, grain, flour, white lead, or other similar substance to be dried, and connected with a blowing or exhausting apparatus of sufficient power to drive or draw the air through and around the substances to be operated upon, in the manner specified, or in any similar manner."

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63. For an *Improvement in Harness adapted to Horse Rakes;* Warren Parker, Putney, Windham county, Vermont, June 26.

The patentee says,—"My improvement consists, 1st, in making the thills or shafts of about two-thirds their usual length, or that which is generally given them, when they are supported by straps extending down from the back of the horse, and at or near his shoulders. 2d, In giving to these shafts, at their front ends, a greater distance apart, or a wider flare or opening, than they usually have. 3d, In bracing them on their front ends, by oblique braces extending from them to the rake head, as seen in the drawings. 4th, In arranging the loop or straps (of the harness) which support the shaft at the rump of the horse, and so as to bring the downward strain directly over his rump, instead of over or just in the rear of his shoulders. 5th, In attaching the tug straps, or draft straps, to the braces at or near their junction with the rake head, or to the rake head, so that they may stand obliquely with respect to the horse."

Claim.—"What I claim as my invention, is the arrangement of the hanging straps, (or contrivances which hold up the thills,) so that they may bear on the rump and hips of the horse, instead of on his back at or near his shoulders, in the usual way; and, in combination with such an arrangement, I claim to make the short and flaring thills, made and applied to the rake head as specified. I also claim the mode of arranging the tug straps and their rear connexions: that is, the arranging them obliquely with respect to the horse, and connecting them to the braces or rake head, as specified."

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64. For an *Improvement in Seats for Railroad Cars;* J. D. Mowry and P. L. Hyde, assignees of Amos W. Snow, Norwich, New London county, Connecticut, June 26.

Claim.—"What I claim as my invention and improvement, is the hori-

zontal rod attached to the frame of the seat, in combination with the fixed standards, when constructed and operating in the manner set forth."

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65. For an *Improvement in Hill Side Ploughs;* Daniel Robb, Sangamon county, Illinois, June 26.

Claim.—"I claim as my invention, the extension of the mould-board, as described, and the arrangement of the mould-board as to make it and the landside revolve together, and enable either the upper or the lower edge to act as a share, and to throw the soil upon either side of the ploughman.

"I also claim as my invention, in combination with the above, the arrangement of the iron rod, and the iron bars, and its arm, so as to secure the mould-board in a firm position when used.

"I also claim as my invention, the construction of a three-sided landside, which is not fastened permanently to the wood-work, but acts independently thereof, as specified."

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66. For an *Improved Adjustable Platform Animal Trap;* James Thomas, West Chester, Chester county, Pennsylvania, June 26.

The patentee says,—"My invention and improvement consists in constructing a trap with an adjustable counterpoise, whereby it can be adapted to catching large or small animals, and when large animals alone are to be caught, it can be adjusted so as to prevent its being discharged by the weight of smaller ones passing over it."

Claim.—"What I claim as my invention, is the combination of the spring spiked frame and adjustable platform, made, arranged, and connected in the manner and for the purpose set forth.

"I likewise claim the combination of the hinged platform with the counterpoise for adjusting the platform, so as to make the trap go off with more or less force, thus adapting it to animals of different sizes."

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67. For *Improvements in the Rotating Permutation Plate Lock;* Henry C. Jones, assignee of Henry Ritchie, Newark, Essex county, New Jersey, June 26.

The patentee says,—"My improvements relate to that class of permutation locks in which the tumbler, which secures the bolt when thrown out, is permitted to move by projections thereon, which enter slots in a series of rotating permutation plates, a shifting index being connected with each of the permutation plates, for the purpose of changing the permutations, and the tumbler being made to move at right angles with the line of motion of the bolt."

Claim.—"What I claim as my invention, is locking the indices to the permutation plates, when the tumbler is thrown up, to lock the bolt by means of the flanches or other equivalent on the tumbler, substantially as described, to prevent the possibility of changing the permutation after the bolt has been locked, as described, when the lock is so arranged that the relation between the dials and the permutation plates may be changed without opening the lock case."

68. For an *Improvement in Churns;* Z. C. Robbins, St. Louis, Missouri, June 26; anté dated June 1.

The patentee says,—"The nature of my invention consists in giving such a form to a rotating agitator that the beaters placed upon it will cut through the milk or cream edgewise, and, by their broad, parallel, or converging surfaces, raise a portion of the cream at each revolution up into the air in the upper part of the churn, and thereby separate the particles thereof."

Claim.—"What I claim as my invention, is the series of floats or beaters, formed and arranged as described, so as, by their thick inclined rear edges, they shall, when their motion is reversed, gather the butter in towards the centre and collect it there, substantially as set forth."

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69. For an *Improvement in Extension Tables;* Thomas P. Sherborne, Philadelphia, Pennsylvania, June 26.

Claim.—"What I claim as my invention, is, 1st, the combination of the projecting pin and the groove with the series of jointed levers, whereby the two ends of the tables are caused to recede from, and approach each other in right lines, which ensures at all times the accurate meeting and joining of the movable and stationary leaves.

"The manner of extending or contracting the table, and holding it in any given position, by means of the combination of the turning rack and pinion with the slotted lever and catches, arranged and operated substantially as set forth.

"The combination of the semi-circular rollers with the groove in the joint pin, for the purpose of securing the latter in place, and forming a bearing for its neck to turn in."

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70. For *Improvements in Instruments for Teaching Music with the Piano Forte;* E. Von Heeringen, Pickensville, Pickens county, Alabama, June 26.

Claim.—"What I claim as my invention, is, 1st, the method of exercising and training the fingers of those who are learning to perform on the piano forte, by springs, weights, or other equivalent device, arranged as set forth, or in any other substantially similar manner.

"2d, I claim the application to the piano forte of an adjustable rod, with pins, sharp points, or any other equivalent device, attached to its upper surface, for the purpose of causing the wrists of the performer to be duly elevated.

"3d, I claim the manner of teaching pupils to move their fingers, hands, and arm below the elbow, parallel to the keys of the instrument, whether playing first, last, or middle octaves, by confining the wrists to blocks which slide on a rod parallel to the front of the instrument, and adjustable to suit different performers, or any other analogous device by which similar results are produced."

71. For an *Improvement in Spark Arresters;* James A. Cutting, Boston, Massachusetts, June 26.

The patentee says,—"The nature of my invention consists in placing above the top of the chimney a deflecting cap, made in the form of an inverted funnel, with the outer part bent down all around in a curve, to reverberate the products of combustion and force them down, when this is combined with a series of radial and inclined or curbed shutes or passages, arranged below the deflecting reverberating cap, through which the products of combustion pass, and by which they are, at the same time, caused to take a revolving motion around the chimney, so that the sparks and other solid matter may be forced into a receptacle below, through a series of radial apertures in a diaphragm, each of the said radial apertures being provided along one edge with an inclined flanch, the better to catch the sparks, &c., and cause them to be deposited, while, at the same time, the passage of the currents through the series of shutes has the effect, in part, to exhaust, whenever the force (such as a jet of steam) which impels the draft is momentarily suspended, and thus continue the draft during the pulsations of the jets of steam.

"My invention also consists in combining with the reverberating cap and series of radial and inclined or curved shutes, an external series of radial and inclined or curved shutes, outside of the first series, together with apertures in the casing, leading into another receptacle, so that, after the products of combustion have been carried around in one direction, the current shall be caused to change its direction, and also to turn upwards and outwards to pass through the second series of shutes, and, whilst revolving, force the solid particles through the apertures into the surrounding and outer receptacle, the reversing of the direction of the revolution below the two series of shutes having the effect to deposit the solid particles in the lower receptacle more effectually than would otherwise be the case."

Claim.—"What I claim as my invention, is, 1st, the deflecting and reverberating cap, and the chimney, in combination with the first series of inclined or curved shutes below the top of the chimney, substantially as described.

"2d, I claim the perforated diaphragm below the shutes, in combination with the inclined shutes and cap, substantially as described.

"3d, I claim the second series of inclined or curved shutes, in combination with the first series of shutes, the cap, and the chimney, substantially as described.

"And finally, I claim the surrounding apertures leading into a receptacle for sparks, in combination with the two reversed series of inclined shutes, substantially as described."

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72. For *Improvements in Harvesters;* Pells Manny, Wadam's Grove, Stephenson county, Illinois, June 26.

The patentee says,—"My invention consists, 1st, in combining revolving spiral cutters with a series of stationary knives, the two being so arranged with respect to each other as to act on the standing grain like the cutting edges of a common shears. 2d, In raising or lowering the cutter frame, in such manner that the cutters shall always act upon the grain at

the angle best suited to the distance from the ground at which the straw is cut, while the band which gives motion to the revolving cutters shall be always kept equally stretched, irrespective of the position of the cutter frame. 3d, In the method of altering the direction of the progressive motion of the machine upon the surface of the ground."

Claim.—"What I claim as my invention, is arranging a series of inclined knives diagonally across the spaces between the fingers, the front end of the cutting edge of one knife projecting beyond the rear end of the cutting edge of the one next succeeding it, substantially as described, and acting in combination with revolving spiral cutters.

"2d, I likewise claim attaching the pole (to whose hinder extremity the team is attached) to the hinder part of the carriage by a pivot, in combination with the ropes and windlass by which it is turned, by which arrangment the machine may be turned in a small space, and without inconveniencing the team."

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73. For an *Improvement in the Boilers and Water Heaters of Locomotive Engines;* Levi B. Tyng, Lowell, Middlesex county, Massachusetts, assignee of Thatcher Perkins, Baltimore, Maryland, June 26.

The patentee says,—"The nature of my improvement consists in the mode of heating water to supply the boilers, and in constructing the parts of the locomotive boiler therefor, by which I protect the smoke box, and employ the waste heat to advantage."

Claim.—"I claim as my invention, 1st, the branch exhaust pipe, surrounded by a water space, combined with the ordinary exhaust pipe, so that a portion or the whole of the steam may be directed through either pipe; the whole being constructed substantially in the manner and for the purpose herein described.

"2d, I claim the water case surrounding the smoke box, into which the supply water is forced to be fed into the boiler, by which I effect the double purpose of heating the water by the waste heat before it enters the boiler, and also protect the smoke box from destruction by the intense heat of the flues and cinders."

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74. For an *Improvement in the Attachment of Harrows to Ploughs;* Jacob Stroop, Philadelphia, Pennsylvania, June 26.

Claim.—"What I claim as my invention, is attaching the harrow to the plough in the manner described: that is to say, attaching the long arm anterior to the coulter, and the short arm in the rear of the sheath, in the manner and for the purpose set forth."

ADDITIONAL IMPROVEMENT FOR JUNE, 1849.

1. For an *Improved Right or Left Hand Lock;* L. R. Livingston, J. J. Roggen, and C. Adams, Pittsburg, Pennsylvania; originally patented May 1, 1849, additional improvement annexed June 5.

Claim.—"What we claim as our invention, is the constructing the lock tumbler of two parts, of such a form, and combined with each other, and

with the arms of the lock bolt, in such a manner in relation to the keyholes, placed in reversed positions near each end of the lock, that a key will operate the tumbler and bolt equally well when inserted into either of the said keyholes, substantially in the manner set forth."

RE-ISSUES FOR JUNE, 1849.

1. For an *Improvement in Cooking Stoves;* R. D. Granger, Albany, New York, assignee of E. Johnson and D. B. Cox, Troy, New York; patented July 22, 1845, re-issued June 19.

The patentees say,—"The first part of our invention consists in making depressions or recesses in the bottom flue below the oven bottom, and towards the sides thereof, so that the greater part of the heated products of combustion shall pass along under the oven plate, through the parts of the flue or flues thus enlarged, and in this way avoid the concentration of heat in the middle of the oven.

"And the second part of our invention consists in combining a fire-place in the front hearth, or in what is called the summer arrangement, with the fire-place in the body of the stove, by means of a pipe or flue passing from the first to the ash pit of the second, and through the front diving flue, which carries down the products of combustion from the fire chamber in the body of the stove to the flue or flues below the oven."

Claim.—"What we claim as our invention, is making the depressions in the bottom flue below the oven, substantially as described, for the purpose of equalizing the heat in the oven, as described.

"And we also claim as our invention, the combination of the two fire-places, by means of a flue pipe connecting the one with the ash pit of the other, and passing through the ash pit to divide the draft, substantially as described, and thus insure the passage of the heated products of combustion from either or both, around the oven, when desired, as described."

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2. For an *Improvement in Screw Wrenches;* Loring Coes, Worcester, Worcester county, Massachusetts; patented April 16, 1841, re-issued June 26.

The patentee says,—"The principle or character of my invention consists in moving the adjustable jaw, by means of a screw placed at the side of, and parallel with, the bar of the permanent jaw and handle, when the required rotation for sliding the jaw is given by a rosette or head, or the equivalent thereof, which retains the same position relatively to the handle.

"And my invention also consists in retaining the required position of the rosette, or its equivalent, by which the required motion is given to the sliding jaw, by having its periphery to work in a notch or recess in the bar of the permanent jaw or handle, or vice versa."

Claim.—"What I claim as my invention, is moving the sliding jaw by a screw, combined with, and placed by the side of, and parallel with the bar of the permanent jaw and handle, substantially as described, when the required rotation for sliding the jaw is given by the head or rosette, or its equivalent, which retains the same position relatively to the handle during the operation, substantially as described.

"And I also claim moving the sliding jaw by a screw, combined with, and placed by the side of, and parallel with, the bar of the permanent jaw and handle, substantially as described, in combination with the rosette, or its equivalent, retained in its position relatively to the hand, in the manner described."

DESIGNS FOR JUNE, 1849.

1. For a *Design for Stoves;* Aug. Qackenboss, assignee of Samuel W. Gibbs, Albany, New York, June 26.

Claim.—"What I claim as my invention, is the ornamental design of stove plates for cooking stoves, as represented in the accompanying drawing."

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2. For a *Design for Stoves;* Charles W. Warnick, Philadelphia, Pennsylvania, June 26.

Claim.—"I claim to be the original inventor or producer of the design and ornamental part of said stove."

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3. For a *Design for Stoves;* Samuel H. Ransom, Albany, New York, June 26.

Claim.—"What I claim as my invention, is the combination and arrangment of ornamental figures and forms, represented in the drawings, the same forming an ornamental design for an elevated oven."

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4. For a *Design for Stoves;* Samuel H. Ransom, Albany, New York, June 26.

Claim.—"What I claim as my invention, is the combination and arrangment of ornamental figures and forms, represented in the annexed drawings, making an ornamental design for an air-tight parlor stove."

List of American Patents which issued in the Month of July, 1849, *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner in the U. S. Patent Office.*

1. For a *Centripetal Press;* James E. Serrell and David Smith, City of New York, July 3.

Claim.—"What we claim as new, is the application of a plurality of pressing blocks, which, with the exception of the bottom and top, enclose on all sides the material to be acted on, and which blocks are so constructed as to allow of their lateral compressing action when moved in the compound direction described by a like number of wedges, or with any analogous or equivalent device, through which any competent power can act to force the blocks with a simultaneous compound and centripetal motion

that concentrates the pressure on a plurality of surfaces of material, to give the material a required form or degree of pressure, substantially as described and shown.

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2. For an *Improvement in Cooking Stoves;* Wm. E. and Henry Bleecker and Samuel D. Vose, Albany, New York, July 3.

The patentees say,—"The invention or improvement consists of the elevation of the sides of the flues, for the purpose of equalizing the heat in the flue under the bottom of the oven."

Claim.—"What we claim as our invention, is making the lower flue, under the oven, elevated at the outsides, formed between the bottom and the bottom oven plates, as described."

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3. For an *Improvement in Keyed Musical Instruments;* Joseph Alley, Newburyport, Essex county, and Henry W. Poole, Worcester, Worcester county, Massachusetts, July 3.

Claim.—"What we claim as our invention, is, 1st, the selectors, cords, and connectors, combined with the valves and the finger key of the common key-board, substantially in the manner and for the purposes set forth.

"2d, The so combining a system of pedals, equal in number to the number of keys or scales to be played in, with the mechanism by which each finger key is connected with the valve and pipe of the desired scale, that, on putting down the pedal belonging to any scale, it shall at once attach to the finger keys, usually employed in playing that scale upon the common organ, the valves of the pipes truly belonging to it, (the scale,) and at the same time raise the pedal that was before down, and detach the valves which are not wanted.

"3d, The pedals, combined with the pulleys, and with the selectors, in the manner and for the purpose set forth."

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4. For an *Improved Manufacture of Bags and Sacks;* William B. Carlock, City of New York, July 3.

The patentee says,—"My invention for weaving bags without seam consists in weaving together two or more warps to form one cloth, and, with the same weft, two or more warps to form the other cloth, when the weft is carried around from one cloth to the other, at one or both ends, to unite the cloths, in combination with the weaving and uniting of the two cloths together, at given distances apart, to form either the closed end or closed sides of the bag."

Claim.—"What I claim as my invention, is the producing a new manufacture of bags, by weaving together two or more warps above, and two or more warps below, to form two or more cloths, when the weft is carried around from the one to the other, at one or both sides, to unite the two cloths, substantially as herein described, in combination with the weaving of the two cloths together at given points, to unite them, by weaving together all the warps at given distances, for forming the closed sides or ends of bags, substantially as described."

5. For an *Improvement in Machines for Cutting Veneers from Cylindrical Blocks;* Benj. S. Stedman, Warren, Worcester county, Massachusetts, July 3.

The patentee says,—"My invention relates to improvements on the machine for sawing, by means of a circular saw, veneers from the periphery of a cylindrical block in the form of a volute, and principally intended for the sawing of ivory, in which great accuracy is required in the movements of the various parts."

Claim.—"What I claim as my invention, is the reciprocating saw carriage, in which the saw is operated by a belt from a driving pulley on the main frame, and passing around a guide pulley on the permanent frame, and the guide pulleys on the carriage, substantially as described, in combination with the carriage which carries the block to be sawed, and which has an intermittent motion towards the saw, derived from the reciprocating motion of the saw carriage, substantially as described.

"I also claim the combination of the apparatus for giving the advancing motion of the block towards the saw, with the apparatus which gives the rotating feed motion to the block, substantially as described; but this I only claim when the two are connected together and derive their motions one from the other, and when the connexion between the two is adjustable to vary their relative motions, substantially as described.

"I also claim the combined apparatus for advancing and rotating the block, in combination with the reciprocating saw carriage, by the means substantially as herein described, when the method of operating the carriage is adjustable to various lengths of blocks, and when the said connexions between the carriage and the advancing and rotating apparatus are adjustable, substantially as described."

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6. For an *Improvement in Machinery for Jointing Staves;* Lewis S. Chichester, Troy, New York, July 3.

The patentee says,—"The object of my invention is to joint staves in the required curve for the bulge or bilge of casks or barrels, without the necessity of bending them in a clamp, as heretofore generally practised."

Claim.—"What I claim as my invention, is the combination of the clamps, for holding and presenting the stave, with a turning spindle, by means of a hinge or other turning joint, substantially as described, for the purpose of presenting the two edges of the stave alternately to the action of the shaving wheel without removing it from the clamp, substantially as described."

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7. For an *Improvement in Winnowing Machines;* John W. Fisk, Rileytown, Butler county, Ohio, July 3.

The patentee says,—"The nature of my improvements consists in giving to the second separating riddle and screen, rocking, vertical, and longitudinal motions, (the screen having in addition thereto a shoveling motion,) the riddle being curved and presenting its concavity upwards, and the screen being in an incline sufficient, when moved, to have a tendency to deliver the heavy grain on the apron leading to the back part of the ma-

chine, while the heavy cheat falls through into the division in front of the apron, and the remnant of light cheat is blown over its front edge, and falls into a division in front of the last mentioned receptacle.

"Another part of my invention consists in curving the riddle aforementioned, and turning its concavity upwards, so as to give the blast of air produced by the fan a full sweep through the load, from its bottom to its top, as it lies on the riddle.

"Another part of my invention consists in hanging the screen to the second separating or concave riddle firmly, and in such wise that their front parts shall end in the same vertical plane, while the screen shall project rearwards one-fifth, more or less, of its entire length beyond the rear of the riddle.

"Another part of my invention consists in deriving the vertical and vibrating motions of the feeder, chaff riddle, apron, and first separating riddle, from the mechanism which gives the vertical, longitudinal, and rocking motion to the second separating or concave riddle and screen."

Claim.—"What I claim as new, is giving rocking, vertical, and longitudinal motions to the lowest or second separating and curved riddle and screen pendant thereto, by means of a mover and guide, curved, attached, and supported as described, or any equivalent device operated in an equivalent manner.

"2d, I also claim the second separating or lowest riddle, having its concavity upwards, in the manner and for the purpose described.

"3d, I also claim deriving the vertical and vibrating motions given to the feeder, chaff riddle, apron, and first separating riddle, from the mover and guide of the second separating and curved riddle and screen, as described, or in any equivalent way."

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8. For an *Improvement in Regulators for Self-Acting Mules;* Ebenezer C. Sanger, Salem, Essex county, Massachusetts, July 3.

The patentee says,—"My improvement is for the purpose of gradually and properly reducing to a certain velocity the speed of the spindles, after the mule carriage has been run out to the extent of its motion, and the necessary amount of twist has been put in the yarns, previous to the backing off of the spindles and running in of the carriage."

Claim.—"What I claim as new, is the regulator, constructed and made to operate substantially as above described, the same consisting of the combination of the weighted centrifugal lever, the lower pawl or click, the ratchet wheel, its cam, and the lever *n*, applied together and to the main driving shaft, and the slide of the twist cam, essentially as specified.

"And, as auxiliary to the above, the second centrifugal weighted lever, and the ring and retractive spring in combination therewith, the same being for the purpose explained."

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9. For an *Improvement in Windmills;* Emory and Emerson Gore, Charleston, Lee county, Iowa, July 3.

The patentees say,—"The nature of our invention consists in propelling machinery by wind or water, by means of horizontal expanding and closing sails or wings, which may be regulated to any force of wind."

Claim.—"What we claim as our invention, is the horizontal expanding and closing sails or wings, as applied for the purpose of propelling machinery by wind or water, in combination with the mode by which they are regulated, as described."

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10. For an *Improvement in Live Spindles and Flyers;* Wm. Mac Lardy and Jos. Lewis, Manchester, England, July 3; anté dated May 9, 1848.

The patentees say,—"Our improvements consist, 1st, in forming the spindle in two separate parts, and connecting the two parts together by a joint or coupling, so that they may revolve together as one solid spindle, and admitting of the upper part being readily disconnected from the lower part when necessary.

"2d, Our improvements in fixing the flyer permanently upon the upper part of the spindle.

"3d, In the employment of a rigid bearing at the top of the spindle, above the flyer, (in connexion with the spindle formed of two parts,) in addition to the bearings usually employed; and,

"4th, In making that portion of the spindle between the top bearing and the flyer, of a smaller diameter than the part of the spindle forming the said top bearing, so that, when the upper part of the spindle is disconnected from the lower part, and raised upwards, the upper portion of the said spindle can be held at such an angle as will admit of the full bobbin being taken off the spindle and replaced by the empty one."

Claim.—"We claim as our invention, the construction and application (to the preparation and spinning of cotton, &c.) of a live spindle formed in two parts, as above described, and having the flyer permanently fixed to the upper part thereof; the upper part of the said spindle being supported in a fixed bearing, and so constructed and arranged as to allow it (when disconnected from the lower part and raised) to be held at an angle whilst doffing the full bobbin, substantially as described."

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11. For a *Machine for Contracting the Circumference of Wrought Iron Bands;* William Massey, Greene county, Illinois, July 3.

Claim.—"What I claim as my invention, is a machine for contracting, by compression, the circumference of every variety of wrought iron bands, wagon tires, &c., and for compressing and shrinking the same, as described, thereby dispensing with cutting and welding."

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12. For an *Improvement in Washing Machines;* Thos. King, West Farms, West Chester county, New York, July 3.

Claim.—"What I claim as my invention, is the combination of the rockers with the dasher and grooves, in the manner and for the purpose described."

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13. For an *Improvement in Attaching Buckles to Suspenders, &c.;* John Abernethy, Woodbury, Litchfield county, Connecticut, July 3.

The patentee says,—"The nature of my invention consists in forming a

clasp of tin, iron, copper, brass, or any other metal in common use, by which to attach the buckle and loop made use of to the elastic or other goods."

Claim.—"What I claim as my invention, is the method, herein described, of attaching buckles, loops, &c., to elastic or other goods, by means of my clasp, which I more particularly use for attaching buckles and loops to springs for vests and pantaloons, using in its construction any metallic plate most suitable for the purpose."

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14. For an *Improvement in Bee Hives;* George Wheeler, Little Valley, Cataraugus county, New York, July 3.

Claim.—"What I claim, is the mode of forming and closing the entrance for the bees, on opposite sides of the hive, by means of a recessed or grooved lighting or bottom board, moving in grooves or otherwise, so as to operate in the manner and for the purpose described; the rectangular slides having projections at one end, and inserted through openings in opposite sides of the case, and moving in grooves in the lower edges of the front and back of the same, for retaining the bottom board in its place when dropped to form an entrance, and for horizontally moving back and forth, to regulate the space of ingress and egress for the bees."

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15. For an *Improvement in Washing Machines;* Lewis W. Colver, St. Louis, Missouri, July 3.

Claim.—"What I claim as new, is the cleansing of cloths or clothing by the combined action of conducting and pressure rollers, with forced jets of suds or water, substantially in the manner set forth."

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16. For a *Rotary Disk, Bolt, and Rivet Machine;* J. L. Kingsley, City of New York, assignee of J. G. Day, Brooklyn, New York, July 3.

The patentee says,—"The nature of my invention consists in the discovery of a speedy and useful way or process for making rivets and blank screws, with machinery therefor."

Claim.—"What I claim as my invention, is the arranging a set of dies upon a disk, or any equivalent thereto, equi-distant from the axis of the disk, and from each other, so that, by giving to the disk an intermittent progressive motion, a die may be brought to each of the several places, for receiving the several actions of feeding, heading, and discharging simultaneously, (while the disk remains at its rest or lock up,) and also cuts off a rod at the time of its revolving or progressive motion, when the disk and dies are combined with any apparatus for heading and discharging rivets.

"2d, I claim the combination of a disk of dies, having an intermittent progressive revolving motion, with an apparatus for heading rivets, and such like articles, whether the latter be constructed in the precise manner described, or by any equivalent mechanism that will produce a like result.

"3d, I claim the combination of a disk of dies, having an intermittent revolving motion, with an apparatus for knocking out or discharging rivets from the dies.

"4th, I claim any common and well known feeding apparatus, or any equivalent thereto, combined with a heading and discharging apparatus, and a disk of dies, having an alternating or intermittent revolving motion, for the purpose of conveying the dies from one position to another as required; the machinery herein described being applicable and competent to perform the several operations when fed with wire or rods, as herein set forth.

"5th, I claim the use of several hammers, to give several blows upon the same rivet, and for making screws, as well as the planing process of nicking as applied to a revolving disk of dies, in combination with the heading, feeding, discharging, and other apparatus and operations of the machine, all of which are herein described and set forth."

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17. For *Improvements in Machinery for Picking Waste;* Joshua Bailey, Cohoes, Albany county, New York, July 3.

Claim.—"I claim, 1st, the shape and form of the pickers used in my machine, as described, as being peculiarly calculated to separate the threads of the material subjected to them, without injuring them and breaking their fibres to such an extent that they become unfit for carding and spinning.

"2d, The combination and arrangement of the whole machine, with the relative action of the cylinder, and roller, and whipper, to and upon each other, by which the material passing through the first feed rollers is, by its relative rate of motion, compared with that of the large cylinder, and also the relative arrangement of the teeth of the rollers, steadily and properly fed to the action of the pickers of the large cylinders, and at the same time held firmly to ensure the due action of the pickers; and by which, also, the second roller is made to seize the unfinished fragments that may be dropped from the first roller, and subjects them to the action of the pickers, in a similar manner to the operation of the first roller, so that the whole substance of the supplied material is thoroughly picked into long fibres, and prepared for carding and spinning into thread.

"3d, I claim as my improvement in waste picking machines, the application of picker cylinders, constructed and arranged to operate together, substantially as herein set forth and described, having teeth made in the manner and form set forth."

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18. For an *Improvement in Circular Saw Mills;* David Philips, Pittsburg, Pennsylvania, July 3.

Claim.—"1st, What I claim as my invention, is making the plate of the saw in sections, whose inner angle rests upon the shaft and is secured to the rings and collar, substantially in the manner described, the radial edges of adjacent sections being separated from each other far enough to admit of the free expansion of the metal from heat without meeting, but connected by means which do not prevent this expansion, whereby the warping or buckling which invariably occur in solid plates, or those whose sections are in contact from partial heating, is effectually prevented, while at the same time the compound sectional plate, thus arranged, possesses sufficient strength and firmness for all practical purposes.

"2d, I likewise claim the method herein described, of preventing and arresting the vibrations in the saw plate, by causing it to pass between cushions, bristles, or other elastic surfaces, arranged as described, or in any other substantially similar manner."

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19. For an *Improved Arrangement of the Sections in a Life-Preserving Hammock;* Samuel J. Seeley, City of New York, July 10.

The patentee says,—"This invention and improvement consists in the construction of a hollow, sectional, air-tight hammock of India rubber cloth, to be inflated with air, and provided with a provision pouch, pillow, water pouch, inflating tubes and valves, loops and toggles, slings, thimbles, lanyards, and other appendages, by which it is made to serve the purposes of a hammock mattress, and, in case of shipwreck, as a life preserver; also as a canoe and ponton, for the support of a bridge raft, for the removal of cargoes from stranded ships, barricades against the small shot of the enemy during an action, and for other purposes."

Claim.—"What I claim as my invention, is making the hammock in three tubular sections, whether each section is composed of one or more tubes, each section being provided with an inflating and disinflating tube, so that, when the hammock is used as a life preserver, the centre section may be disinflated in whole or in part, thus forming a boat and retaining the occupant in his position, as set forth."

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20. For an *Improvement in Brick Presses;* Wm. B. Waldran and Godfrey Hargitt, Memphis, Shelby county, Tennessee, July 10.

Claim.—"What we claim, is the combination of the mud box and moulding apparatus, as described, consisting of a plunger to which a cutter is affixed, and connecting therewith the horizontal feeder, as fully set forth. We also claim, in combination with the above parts, the compressing apparatus adapted to this machine, for compressing bricks, and consisting of the press plate and press brick lever, constructed and operating as set forth."

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21. For an *Improvement in Mills for Grinding;* Thomas A. Chandler, Rockford, Winnebago county, Illinois, July 10.

The patentee says,—"The nature of my invention and improvement consists in combining a series of two or more grinding cylinders, running at unequal velocities, and vibrating in a direction parallel to their axes, and with equal or unequal and opposite motions, these rollers being placed nearly in contact, in order that grain passed between them may be crushed and rubbed in opposite ways at the same time, and thus be uniform and finely pulverized by the least possible contact with the grinding surfaces; the grinding cylinders, which are hollow, being kept cool by the circulation of a current of air through them, which is kept flowing by the action of oblique openings in their ends, those of one end being inclined in the contrary direction to those of the other, in order that one set of openings may favor the entry, and the other the escape of the air."

Claim.—"What I claim as new, is the combination of two or more re-

volving oscillating cylinders, arranged and operated substantially as herein described, for the purpose of grinding grain and other substances.

"I likewise claim the manner herein described, of preventing the cylinders and the journals of their axes from becoming unduly heated, by keeping a constant current of air circulating through them by the action of the oblique lips of the radial apertures in their ends, as herein described."

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22. For a *Spring and Tackle Sash Stopper;* John W. Hoffman, Philadelphia, Pennsylvania, July 10.

Claim.—"What I claim as my invention, is the application of the spiral spring, and also pulleys, applied and operating substantially as described, for raising and lowering window sash in windows."

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23. For an *Improvement in Pressing Bonnets;* Miss C. C. Dow, Windham, Windham county, Connecticut, July 10.

Claim.—"What I claim as my invention, is, 1st, the combination of the suspended core box with a smooth steel pressing plate fastened to its under surface, tri-branched pressing bar, curved suspension and lifting springs, crane, adjustive connecting rods, swiveled bow, and the adjustive treadle, constructed, arranged, and operated in the manner and for the purpose set forth.

"2d, I also claim constructing the suspended box, to receive the core, in the manner and for the purpose set forth, irrespective of the parts to which it is connected and suspended.

"3d, I also claim the combination of the pressing iron, slotted lever, key, jointed connecting rod, and perforated arm to which the lever is connected, with the table to which the horizontal perforated arm is secured, for pressing the tip of the bonnet whilst on the roller of the crank shaft."

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24. For an *Improvement in Distilling Apparatus;* Charles A. Krechler, Stockholm, Sweden, July 10. (Surrendered and cancelled Oct. 18.)

Claim.—"What I claim as my invention, is the combination of one or more charcoal chambers, and one or more water vessels, arranged and applied together substantially as above specified, and for the purpose of cleansing the alcoholic spirit of ætherical oil (called in the German language Fusel öhl) and water, essentially as explained; each of the said charcoal chambers being made either with or without the reflecting disk or plate arranged in its top, the same (viz., the disk) being for the purpose of causing the vapor which passes into the charcoal to escape laterally, and impinge against the surrounding cooling vessels, whereby its water may be condensed, which would not so effectually take place were the vapor to pass directly and vertically through the mass of charcoal."

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25. For an *Improved Window Shutter Fastener;* Jacob Stroop, Philadelphia, Pennsylvania, July 10.

Claim.—"What I claim as my invention, is the combination of the pin, clasp, and side bolt, arranged as described, with the sash when fastened,

so that the clasp cannot be raised from the pin, nor the sliding bolt from its catch, so long as the sash is fastened, thereby securing the shutters at top and bottom, and entirely prevent their being loosed by boring through the shutter, as described and represented."

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26. For an *Improvement in Portable Cot Bedsteads;* Abraham McDonough, Philadelphia, Pennsylvania, July 10.

Claim.—"What I claim as my invention, is the construction of a folding cot bedstead, as described: that is to say, the folding legs, with hinges, combined with the connecting support and thumb screws, in the manner and for the purpose set forth."

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27. For an *Improvement in the Method of Arranging and Working the Valves of Auxiliary Engines for Feeding Boilers;* Richard Van Dyke, Jr., assignee of Rufus Porter, City of New York, July 10.

Claim.—"What I claim as my invention, is the combination of the valves, the cross head, the valve rod, and the hollow piston rod, arranged in the manner and for the purpose described. I also claim the mode described of working the valves by means of the plate spring."

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28. For an *Improvement in Machinery for Spinning Cotton;* Charles K. Tisdale, joint inventor with, and assignee of, James and Thomas Keane, Cornwall, Orange county, New York, July 17.

The patentees say,—"The nature of our invention consists in improvements in the stationary spinning frame, whereby we are enabled to spin the peculiar kind of yarn now only obtained from the machine known as the mule, or modifications of that machine, and lies in combining the instrument known as the 'ring and traveler' with the pointed spindle, similar to that used on the mule, and operated so that the points of the spindles will always remain at one fixed distance from the rollers."

Claim.—"What we claim as of our own invention, is the continuous and unintermitted spinning of 'slack twisted yarns,' similar to, and of the kind heretofore only spun upon mules and like machines, upon the stationary spinning frames, by passing the said yarn directly from the front roller upon the point of the spindle, without any intervening guide wire or guide, and without changing the relative positions of the rollers and spindles, as set forth and described."

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29. For an *Improvement in Wheat Cleaning Machines;* David L. Ewing, Spruce Hill, Juniata county, Pennsylvania, July 17.

The patentee says,—"The nature of my improvement consists in employing two extended rubbing surfaces, pressed together with a force sufficient to break any substance of less tenacity than wheat, but elastic, so as to yield for any variation of feed, by which means rat-dung and other similar substance is broken fine, and, by a blast of air, carried away from the grain."

Claim.—"What I claim as new, is the employment of the leather-covered

cylinder, in combination with the leather-covered spring concave, constructed substantially as above described, for removing rat-dirt and other substances from wheat, as set forth."

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30. For an *Improvement in Ox-Yoke Fastenings;* Andrew Hotchkiss, Sharon, Litchfield county, Connecticut, July 17.

Claim.—"I claim the construction of the curved arms, as formed according to the above description, so as to embrace with their front parts the bow, the rear parts being so shaped as to form a thumb and finger piece, by which the grasp of the arms may be released, together with the spring by which the arms are kept closed.

"I claim the pin as a whole, with the entire combination of pin proper, arms, and spring, as set forth."

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31. For an *Improvement in Cutting, Crushing, and Grinding Vegetables;* Luther B. Fisher, Freeport, Stephenson county, Illinois, July 17.

Claim.—"What I claim as my invention, is the adjustability of the cylinder and its parts, as shown, for aiding the feeding, in combination with the cutting and grinding apparatus within said cylinder, as set forth."

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32. For an *Improvement in Lounge and Chair Combined;* Abner J. Linikin, Roxbury, Norfolk county, Massachusetts, July 17.

Claim.—"What I claim as my invention, is the arrangement and combination with each other of the back, side, arms, and forward supports of the arms of the chair, for folding up when the instrument is to be used as a bed.

"I also claim the construction and use of the double inclined plane, for the double purpose of a pillow to the lounge, and for a writing desk, as described."

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33. For a *Method of Increasing the Effective Length and Cleansing Boiler Flues;* Abner Chapman, Fairfax, Franklin county, Vermont, July 17.

The patentee says,—"The nature of my invention consists in furnishing the horizontal flues of a steam boiler with spiral partitions, which partitions can be made to revolve to clear the flue, by which arrangement I am enabled to obtain all the advantages of a spiral flue, which has been heretofore essayed and found useful, till it became choaked with ashes, &c., when it was found impossible to clean it; but, by my construction, the inside or spiral flue can be revolved, and thus be made to clean the flue perfectly, while it retains all the advantages of the stationary spiral flue."

Claim.—"What I claim as my invention, is spiral partitions, forming a spiral flue within the flues of a steam boiler, substantially as described, said thread being affixed to a shaft independent of the flue, so that it can be made to revolve, to scrape the flue, and clear it when it gets foul."

To be continued.

MECHANICS, PHYSICS, AND CHEMISTRY.

On an Equation between the Temperature and the Maximum Elasticity of Steam and other Vapors. By WILLIAM JOHN MACQUORN RANKINE, *Civil Engineer.**

In the course of a series of investigations founded on a peculiar hypothesis respecting the molecular constitution of matter, I have obtained, among other results, an equation giving a very close approximation to the maximum elasticity of vapor in contact with its liquid at all temperatures that usually occur.

As this equation is easy and expeditious in calculation, gives accurate numerical results, and is likely to be practically useful, I proceed at once to make it known, without waiting until I have reduced the theoretical researches, of which it is a consequence, to a form fit for publication.

The equation is as follows:—

$$(1.) \qquad \text{Log. } P = \alpha - \frac{\beta}{t} - \frac{\gamma}{t^2}$$

Where P represents the maximum pressure of a vapor in contact with its liquid:—

t, the temperature measured on the air thermometer, from a point which may be called the ABSOLUTE ZERO, and which is—

274°·6 of the *centigrade scale* below the freezing point of water.

462°·28 of *Fahrenheit's scale* below the *ordinary* zero of that scale, supposing the boiling point to have been adjusted under a pressure of 29·922 inches of mercury, so that 180° of Fahrenheit may be exactly equal to 100 centigrade degrees.

461°·93 below the ordinary zero of Fahrenheit's scale, when the boiling point has been adjusted under a pressure of 30 inches of mercury, 180° of Fahrenheit being then equal to 100°·0735 of the centigrade scale.

The *form* of the equation is given by theory; but three constants, represented by α, β, and γ, have to be determined for each fluid by experiment.

The inverse formula, for finding the temperature from the pressure, is of course

$$(2.) \qquad \frac{1}{t} = \sqrt{\frac{\alpha - \text{Log. P}}{\gamma} + \frac{\beta^2}{4\gamma^2}} - \frac{\beta}{2\gamma}$$

It is obvious that for the determination of the three constants, it is sufficient to know accurately the pressures corresponding to three temperatures; and that the calculation will be facilitated if the reciprocals of those temperatures, as measured from the absolute zero, are in arithmetical progression.

* From the Edinburgh New Philosophical Journal, for July, 1849.

In order to calculate the values of the three constants, for the vapor of water, the following data have been taken from M. Regnault's experiments:—

Temperatures in Centigrade degrees.		Common Logarithms of the Pressure in Millimetres of Mercury.	REMARKS.
Above the Freezing Point.	Above the Absolute Zero.		
220°·00	494°·60	4°·2403000	Measured by M. Regnault on his curve, representing the mean results of his experiments.
100·00	374·60	2·8808136	Logarithm of 760 millimetres.
26·86	301·46	1·4198000	Calculated by interpolation from M. Regnault's general table.

These data give the following results for the vapor of water, the pressures being expressed in millimetres of mercury, and the temperatures in centigrade degrees of the air thermometer:—

$$\text{Log. } \gamma = 5{\cdot}0827176 \qquad \text{Log. } \varepsilon = 3{\cdot}1851091$$
$$\alpha = 7{\cdot}831247.$$

Table I. exhibits a comparison between the results of the formula and those of M. Regnault's experiments, for every tenth degree of the centigrade air thermometer, from 30° below the freezing point to 230° above it, being within one or two degrees of the whole range of the experiments.

M. Regnault's values are given, as measured by himself, on the curves representing the mean results of his experiments, with the exception of the pressures at 26°·86, one of the data already mentioned, and that at — 30°, which I have calculated by interpolation from his Table, series *h*.

Each of the three data used in determining the constants is marked with an asterisk. (*)

In the columns of differences between the results of the formula and those of experiment, the sign + indicates that the former exceed the latter, and the sign — the reverse.

Beside each such column of differences is placed a column of the corresponding differences of temperature, which would result in calculating the temperature from the pressure by the inverse formula. These are found by multiplying each number in the preceding columns by $-\frac{dt}{d\,\mathrm{P}}$, or by $\frac{-dt}{d\,\text{Log. P}}$, as the case may require.

TABLE I.—*Vapor of Water.*

Temperatures in Centigrade degrees of the Air Thermometer from The freezing point.	The absolute zero.	Pressures in millimetres of Mercury, according to The Formula.	M. Regnault's Experiments.	Difference between Calculation and Experiment in millimetres.	Corresponding differences of temperature.	Common Logarithms of the Pressures in millimetres according to The Formula.	M. Regnault's Experiments.	Differences between Calculation and Experiment in Logarithms.	Corresponding differences of temperature.	Temperatures above the freezing point.
— 30°	244°60	0·35	0·34	+ 0·01	— 0°42					
— 20	254·60	0·89	0·91	— 0·02	+ 0·25					
— 10	264·60	2·07	2·08	— 0·01	+ 0·06					
0	274·60	4·47	4·60	— 0·13	+ 0·38					
+ 10	284·60	9·05	9·16	— 0·11	+ 0·18					
20	294·60	17·33	17·39	— 0·06	+ 0·06					
*26·86	301·46	26·29	26·29	0·00	0·00					
30	304·60	31·57	31·55	+ 0·02	— 0·01					
40	314·60	55·05	54·91	+ 0·14	— 0·05					
50	324·60	92·26	91·98	+ 0·28	— 0·06					
60	334·60	149·15	148·79	+ 0·36	— 0·05					
70	344·60	233·48	233·09	+ 0·39	— 0·04					
80	354·60	355·04	354·64	+ 0·40	— 0·03					
90	364·60	525·70	525·45	+ 0·25	— 0·01					
*100	374·60	760·00	760·00	0·00	0·00	2·8808136	2·8808	0·0000	0°00	100°
110	384.60	1074·82	1073·70	+ 1·12	— 0·03	3·0313620	3·0307	+ 0·0007	— 0·05	110
120	394·60	1490·10	1489·00	+ 1·10	— 0·02	3·1732040	3·1734	— 0·0002	+ 0·01	120
130	404·60	2028·00	2029·00	— 1·00	+ 0·02	3·3070610	3·3076	— 0·0005	+ 0·04	130
140	414·60	2713·80	2713·00	+ 0·80	— 0·02	3·4335760	3·4332	+ 0·0004	— 0·03	140
150	424·60	3575·50	3572·00	+ 3·50	— 0·04	3·5533340	3·5537	— 0·0004	+ 0·03	150
160	434·60	4643·60	4647·00	— 3·40	+ 0·03	3·6668530	3·6676	— 0·0007	+ 0·06	160
170	444·60	5951·20	5960·00	— 8·80	+ 0·06	3·7746030	3·7750	— 0·0004	+ 0·04	170
180	454·60	7533·70	7545·00	— 11·30	+ 0·07	3·8770050	3·8772	— 0·0002	+ 0·02	180
190	464·60	9428·50	9428·00	+ 0·50	— 0·00	3·9744430	3·9743	+ 0·0001	— 0·01	190
200	474·60	11675·00	11660·00	+ 15·00	— 0·06	4·0672680	4·0674	— 0·0001	+ 0·01	200
210	484·60	14315·00	14308·00	+ 7·00	— 0·02	4·1557960	4·1561	— 0·0003	+ 0·03	210
*220	494·60	17390·00	17390·00	0·00	0·00	4·2403000	4·2403	0·0000	0·00	220
230	504·60	20945·00	20915·00	+ 30·00	— 0·08	4·3210830	4·3207	+ 0·0004	— 0·05	230
[1.]	[2.]	[3.]	[4.]	[5.]	[6.]	[7.]	[8.]	[9.]	[10.]	[11.]

In comparing the results of the formula with those of experiment, as exhibited in Table I., the following circumstances are to be taken into consideration:—

First, That the uncertainty of barometric observations amounts in general to at least one-tenth of a millimetre.

Secondly, That the uncertainty of thermometric observations is from one-twentieth to one-tenth of a degree, under ordinary circumstances, and at high temperatures amounts to more.

Thirdly, That, in experiments of the kind referred to in the table, those two sorts of uncertainty are combined.

The fifth column of the table shews that, from 30° below the freezing point to 20° above it, where the minuteness of the pressures makes the barometric errors of most importance, the greatest difference between experiment and calculation is $\frac{13}{1000}$ of a millimetre, or $\frac{1}{200}$ of an inch of mercury, a very small quantity in itself, although, from the slowness with which the pressure varies at low temperatures, the corresponding difference of temperature amounts to $\frac{38}{1000}$ of a degree.

The sixth and tenth columns shew that, from 20° to 230° above the freezing point, the greatest of the discrepancies between experiment and observation corresponds to a difference of temperature of only $\frac{8}{100}$ of a degree, and that very few of those discrepancies exceed the amount corresponding to $\frac{1}{20}$ of a degree.

A comparison between the sixth and tenth columns shews that, for four of the temperatures given, viz., 120°, 150°, 200°, and 210°, the pressures deduced from M. Regnault's curve of actual elasticities, and from his logarithmic curve respectively, differ from the pressures given by the formula in opposite directions.

If the curves represented by the formula were laid down on M. Regnault's diagram, they would be almost undistinguishable from those which he has himself drawn, except near the freezing point, where the scale of pressures is very large, the heights of the mercurial column being magnified eight-fold on the plate. In the case of the curves of logarithms of pressures above one atmosphere, the coincidence would be almost perfect.

The formula may therefore be considered as accurately representing the results of all M. Regnault's experiments throughout a range of temperatures from 30° of the centigrade scale below the freezing point to 230° above it, and of pressures from $\frac{1}{2200}$ of an atmosphere up to 28 atmospheres.

It will be observed that equation (1.) bears some resemblance to the formula proposed by Professor Roche in 1828, viz:

$$\text{Log. } P = A - \frac{B}{T+C}$$

where T represents the temperature measured from the ordinary zero point, and A, B, and C, constants, which have to be determined from three experimental data. It has been shewn, however, by M. Regnault, as well as by others, that though this formula agrees very nearly with observation throughout a limited range of temperature, it errs widely when the range is extensive. I have been unable to find Professor Roche's memoir, and I do not know the reasoning from which he has deduced his formula.

The use in computation of the equations I have given, whether to calculate the pressure from the temperature, or the temperature from the pressure, is rapid and easy. In Table II. they are recapitulated, and the values of the constants for different measures of pressure and temperature are stated.

In calculating the values of α the specific gravity of mercury has been taken as 13·596.

Temperatures measured by mercurial thermometers are, in all cases, to be reduced to the corresponding temperatures on the air thermometer, which may be done by means of the table given by M. Regnault in his memoir on that subject.

To be Continued.

For the Journal of the Franklin Institute.

On Smelting Magnetic Iron Ores. *By* Mr. H. Fairbairn.

Amongst the most interesting branches of observation which are presented to the view of the traveler, amongst the iron furnaces and through the iron ore regions of Pennsylvania, none is of more striking importance, in its probable ultimate revolutionary consequences on all the future iron manufacturing of Europe and of America, than the progress towards perfection in the yet imperfectly established system of smelting the magnetic iron ores of Pennsylvania, or those ores which abound in the primitive rocks in various parts of the State.

Although these iron ores have been hitherto known, in a manufacturing point of view, principally in New Jersey, or in Pennsylvania, and only in the region of the Lehigh river, yet the geology of this part of the continent of America displays, in the utmost distinctness, the continuation of the same rocks through a very wide range of country, from North to South,—from Connecticut through New Jersey, New York, Pennsylvania, Maryland, Virginia, South Carolina, and the South-Western States, under various local names. The mountains are of primitive formation, and they are universally non-volcanic,—the strata consequently continuous, and unbroken by the mechanical forces which have disturbed the stratification of so large a part of the European countries,—and the same iron ores may be reckoned upon as existing almost everywhere throughout the range of the primitive mountains of the United States.

The degradation of the mountains is various, as local circumstances may have produced aqueous decomposition in the varying degrees; but this has served the very useful purpose of laying open the deposits of iron in all the stages of geological formation, and it only remains for the manufacturer of iron to choose his location over hundreds of miles of country; or if fuel be absent from any part of the region where a particular iron ore be seen upon the surface, then to dig will be to find (in almost any other situation) the magnetic iron ores, at some depth, however various, between the surface and the granite foundation of the earth.

Scattered furnaces there are throughout Virginia, Maryland, South Carolina, and Alabama, and these furnaces are all engaged in the smelting of the magnetic ores of iron; but they are principally charcoal furnaces, on

the comparatively petty scale which is that of all iron furnaces dependent on wood for fuel, in this age of colossal competition for the manufacture of the iron of the world at large.

Through the circumstance of the existence of the anthracite coal fields in the State of Pennsylvania, and that all the ores of iron exist also in the nearest vicinity to coals and to limestone, it may be stated that the iron ores and the iron manufactures of Pennsylvania are substantially to be the future iron ores and manufactured iron of the United States. Time may develope other modes of smelting, in which coals may not be the all important consideration, but no extensive manufacture of iron can now exist at any considerable distance from the coal fields of Pennsylvania, however rich and abundant may be the magnetic iron ores of the more southern States. And although, in Pennsylvania, the circumstance of the greater accessibility of the magnetic iron ores in the region of the Lehigh river, has hitherto appeared to confine the smelting of these ores to that particular quarter of the State, yet throughout the whole of the region between the Lehigh and the Schuylkill, the same ores can be mined where a demand for iron ore exists; and either at Easton, on the Lehigh, or at Reading, on the Schuylkill, iron furnaces can be supplied in any quantities, however illimitable, of magnetic iron ores, at an average cost of three dollars per ton.

These ores are the richest of all the ores of iron,—not the most productive of iron in the greatest quantities only, but the iron is of the finest quality which is thus made from the magnetic ores of the United States. From the same oxides of iron is produced all the fine iron of Russia, Sweden, and Norway,—countries which are situated in similar primitive geological formations with a large portion of the State of Pennsylvania,—and whilst the search has been in vain for magnetic iron ores in England, yet in the return to the House of Commons of the importations of iron for the late years of 1848–9, which was made on the motion of Sir John Guest, there is an entry of "1340 tons of chromate of iron from Norway and the United States." There is every variety of iron ore to be found in Pennsylvania, from the richest oxides of Russia to the leanest carbonates of Wales.

But the magnetic iron ores have yet been comparatively useless to the iron manufacturer of Pennsylvania, and Russian and Swedish iron continues to be imported into the United States, although made from the same ores which lie in whole millions of tons on the granite rocks of the Lehigh. The only instance in which the magnetic oxides have been smelted without admixture with hematite ores, is mentioned by Professor Walter R. Johnson, in favor of the Stanhope furnaces, in New Jersey; and though the work of Professor Johnson is now of some ten years in date, yet is there no furnace at this time on the Lehigh river where pig iron is produced with any regularity, unless with considerably more than one-half of the softer hematite ores. There are, occasionally, reports of extraordinary success in the attempts which may be made at particular furnaces to smelt the magnetic ores alone; and, for a short time, there is pig iron in the markets which sells at prices very far over the usual anthracite iron, of which there is an instance at this time of such pig iron being sent from a furnace on the Lehigh to Sheffield, in England, for the steel manufacture

of a place which depends almost entirely on Russia and Sweden for the raw material of steel. Yet this successful smelting of the magnetic iron ores never long fails to be followed by some important damage to the furnace; and it is generally considered that it is not practicable to smelt iron with profit to the manufacturer, when using the magnetic oxides of iron, unless with the admixture of considerably more than one-half of the inferior hematite ore.

But this admixture of inferior ore is fatal to the manufacture of iron, on the Lehigh, or elsewhere in Pennsylvania, in competition with the iron of Russia; for the quality of the metal is deteriorated, and the expense is increased, of manufacturing iron from hematite ores, which are usually brought from considerable distances to the furnaces on the river Lehigh. Great quantities of hematite ores are annually sent round from the Schuylkill river to the furnaces in New Jersey, and this ore is sold at an average of one dollar per ton above the magnetic ores, an expense which is most needlessly incurred, from a supposed impossibility that the magnetic ores can be smelted alone.

To overcome this difficulty in the reduction of the magnetic oxides of iron is, therefore, of the utmost importance in the anthracite iron manufacture of the United States. Certain it is, that iron equal to that of Russia can be produced from the magnetic ores of Pennsylvania,—for the Exhibition of the Franklin Institute exhibited such iron in the late year of 1849; whilst the steel manufactured at the Adirondac works, in New Jersey, is also from American iron, and the iron recently produced at the largest furnace on the Lehigh river, is reported from the rolling mills to be fully equal to Russian or to any other iron, with respect to malleability, but that, in the process of puddling, a considerable per centage of its weight has been found to be lost. This latter circumstance may probably lead to the better management of the process of smelting the magnetic iron ores of the United States.

For, against the alleged impossibility of smelting a hard magnetic oxide of iron, there is the refutation in the daily practice of the iron founder, who melts the pig metal itself, and it will not be said that there is any iron ore which is harder than the pig. The practice of the iron founder may, therefore, point to the true modes of smelting the magnetic ores of the United States.

It is the absence of the waste alone—of three-quarters of the coals, and the limestone—which enables the founder to reduce the metal itself, which yet cannot be produced by the smelter from the yet much more reducible form of the ore.

There is no iron foundry in which more than five cwt. of anthracite coal is used for the smelting of one ton of pig metal, and yet the cupola furnace is blown with cold air, and loses immensely more heat by radiation than is lost from a smelting furnace through walls of many feet in thickness. But the iron founder does not use his coal in enormous lumps, of which the greater part is useless in the smelting process and lost in the air. Were the cupola furnace filled with lump anthracite coal, two tons would equally be required for smelting a ton of pig iron, as a ton of iron from ores which are almost all iron, for there is frequently 90 per cent of iron contained in the magnetic ores.

But though these ores are almost all iron, and the quantity of earthy adulterations less than in any other iron whatever, yet is there, in the iron furnaces on the Lehigh, no change or shadow of alteration from that everlasting "ton of limestone," which appears to be thrown into every iron furnace in every place and region in the United States. The founder uses only some small portion of lime, a few pounds of oyster shells being sometimes all that is used for melting a ton of pig metal of impure quality, but more frequently none whatever is used in the cupola furnace; and if the earthy ingredients in the ores be only 10 per cent., or 2 cwt. in the ton, then 1 cwt. of limestone is the true quantity to be used in the smelting furnace, the waste of limestone being one of the leading causes of the unsuccessful attempts to produce iron for steel from the magnetic ores of the Lehigh. The unusual waste of iron in the puddling furnace is owing only to the calcareous and carbonaceous concretions which remain from the excessive use of anthracite coals and of limestone in the smelting process, for the loss is not of metal, but of impurities which have been inserted in it, at a very considerable expense, and only to be again extracted by the further very heavy expense which attends all puddling of iron in the United States.

The chemistry of red short iron may not have been very clearly ascertained, and the phosphoretic substance which Bergman found on the analysis of one kind of iron, may not improbably be now sometimes mistaken for the metal of calcium, or of deoxydized lime, which may remain in the metal by the greater specific gravity which will cause its precipitation amongst the metal in the hearth; but certain it is, in all practical iron manufacturing, that pig iron is rendered the more brittle by the excessive use of lime, and this excess is most enormous throughout the iron manufacture of the United States.

In order to illustrate, from actual practice, the undoubted error of using this excessive and unvarying quantity of limestone in the American anthracite iron manufacture, it is here proposed to bring into notice the comparative quantities of limestone and other materials used, formerly and now, in Scotland, and under different temperatures of blast.

At the Clyde iron works, in 1831, the blast at 280° Fahr.

	tons.	cwt.
Coal for fusion, 1 ton;—18 cwt. of coke; in coal,	4	6
For the hot blast apparatus,	0	5
Blowing machine,	0	7
Limestone,	0	9

In 1833,—temperature of blast, 612°.

	tons.	cwt.
For fusion,	2	0
Hot air apparatus,	0	8
Blowing engine,	0	11
Limestone,	0	7

Here is seen a reduction of limestone to 7 cwt. per ton of pig iron, at a temperature of 612°, and this quantity is still in use very generally in Scotland, although the limestone of Scotland is only the mountain limestone which intervenes in the bituminous coal measures, and far inferior in quality to the transition limestone of the Schuylkill region, which approaches to almost perfect purity when taken from any low part of the stratum, and usually contains 94 per cent. of pure lime.

That the brittleness of anthracite iron is owing only to errors in its manufacture, is further rendered probable from everything that is known of the quality of the iron produced from hematite ores in other parts of the world. At Ulverstone, in England, iron is made with charcoal from hematite ores, and this iron possesses so nearly the soundness of the iron of Sweden as to be almost equally valuable in the market; nor has it even been doubted that hematite iron ore is second only in value to the magnetic oxides from a lower situation in the primitive rocks. The "ton of limestone" is the greatest misfortune that ever was imported into the manufacturing system of the United States

Besides the loss of anthracite coal, and of limestone, with all the injurious effects upon the metal which so arise from their use in excess, there would seem to be another important error in the filling of the furnaces with the magnetic oxides of iron, in an insufficiently reduced state. This variety of iron ore of a specific gravity proportioned to its great content of pure iron,—probably three times heavier than anthracite coal or limestone, or more than double the weight of the hematite or argillaceous iron ore with which it is intermixed so universally at the furnaces on the river Lehigh. The magnetic iron ore will therefore tend to fall, by its greater gravity, through and below the coals, the limestone, and the other ores in the furnace at the same time, lying impressed against the boshes, obstructing the blast, impeding its own reduction, and causing much of the superincumbent coal to be lost to the process of smelting and wasted at the tunnel head. The continual "chills" which occur at the furnaces which use any important quantity of magnetic iron ores, are probably to be much traced to that merely mechanical cause. The remedy for this obstruction is very easily to be found by reducing the magnetic ores to the smallest size,—as in Sweden the ores are always broken to about the dimensions of an ordinary egg,—and by filling also the furnace with the ores more intimately mixed with the limestone and the coals. The expense of the reduction of these magnetic ores to even very minute dimensions, by stamping machinery, would be amply repaid by the facility with which they would be smelted, with the greater quantity of iron which a furnace would produce, and the greater duration of the brickwork of the walls.

The internal form of the furnaces on the Lehigh, which are universally cylindrical, must be viewed as another impediment to the successful smelting of these heavy magnetic iron ores, which will press with increased force, by their greater weight, against the walls of a furnace with an imperfect internal curve. A chill of very great consequential damage has occurred recently at the furnace which was becoming known for the production of iron selling readily for $26 per ton, against the iron of neighboring anthracite furnaces at $19 per ton, and the furnace in question is of the cylindrical internal form. On the other hand, the Stanhope furnaces are true circles, according to Prof. Johnson; and he mentions, as with exultation, that these furnaces had reduced the magnetic ores without mixture with ores of any inferior kind.

These are the undoubted causes of the unsuccessful attempts to smelt the most valuable of all the ores of iron—the magnetic oxides of the Lehigh region; nor is there any truth whatever in the usual reasoning of the proprietors of iron works, that the use of the hot blast is the cause of the

difficulty in the production of iron for the purposes of steel. It has been settled long since, not more, theoretically, by the extensive series of experiments which were made by Messrs. Fairbairn and Hodgkinson, for the British Association for the Advancement of Science, than by the daily subsequent experience at all the principal iron works in Scotland, that there is no difference in the quality of iron made by hot air or by cold, or that the difference has been in favor of the hot blast system of smelting, a much larger increase of No. 1 iron having been produced at the Clyde iron works, by the same furnace and from the same materials, after the change to the use of heated air. The opinion that hot blast iron is inferior in quality has long since been exploded at all the iron furnaces of Great Britain, and the hot blast is assuredly not the cause of the inferiority of the great bulk of the anthracite iron of the production of the United States.

By the abandonment of the present very rude and unreasoning modes of building, of filling, and of blowing the iron furnaces of Pennsylvania, it would very soon cease to belong to the serfs of Russia to supply the finest of iron from underneath the snows of the Ural mountains, to all the rest of the nations of the modern world. This occupation is very clearly destined to belong to the people of the United States, for all the rarest of the oxides of iron are to be found in the primitive mountains of the Atlantic States, and to use these treasures on some system approaching to the resemblance of mechanical and chemical science, is all that would appear to be required to the early and entire ascendency of the iron and steel manufacture of this quarter of the world,—for there would be no difficulty in smelting magnetic iron ores were the process conducted on any reasonable plan, and when not pig iron only, by the founder, but Russian and Swedish bars, by the manufacturer of steel, and even cobalt, is reduced daily, (although this is amongst the most refractory of all the metals,) it follows that there is no iron ore whatever which cannot be reduced with the greatest comparative ease.

On the supposition that the magnetic ores have only been neglected or disused from causes which the improvement of the general iron manufacture may cause to pass away, then as the deposites of magnetic ores are shown to be boundless for any possible requirement for future manufacturing purposes, a chain of remarkable consequences may be seen to follow the establishment of iron and steel manufactures in the regions of these ores; for not only may the finest of iron be made in any possible quantities in Pennsylvania, but the most valuable of all the varieties of iron may come to be made at a less expense than the worst. One ton of magnetic iron ore will produce more metal than two tons of ordinary hematite, or than three tons of carbonate of iron, whilst the expense of mining the richest will not be greater than the leanest of the ores; and thus may all other smelting become unprofitable in any other regions but those which contain the ores of the original rocks. Russians, Norwegians, and Swedes would then cease to be the sellers of all but inferior iron to such nations as Great Britain and the United States; and as the British islands possess a geology not within the probabilities of any deposites of iron ore of a class superior to the hematites, the State of Pennsylvania and its anthracite coal regions would appear to be destined to take a very high rank in the future manufacture of iron for the world at large.

But this only can be the result of the most economical use of the iron ores of the finest quality, since the difference is daily becoming less in favor of any particular nation in any particular pursuit of manufactures or of foreign trade. Navigation is cheapened and more expeditious from year to year, and the freight of commodities is daily lessened over the sea. The difference in favor of the American iron manufacturer would be only the expense of conveying magnetic iron ore from the Lehigh to Scotland or to Wales, as the chromate of iron is now taken to Great Britain from Maryland at Havre de Grace, and the cost of the freight is comparatively less, the more valuable may be the ores which may yet come to light from the primitive mountains of the new world. Specimens of both meteoric iron and of specular iron ore were recently shown to the writer of these observations, by proprietors of iron furnaces on the Lehigh river, and when the non-volcanic character of the region is preserved in view, and reflecting that the specular iron ore is in entire hills in the Island of Elba, in the Mediterranean Sea, that the laws of comparative geology render probable the existence of the same ore in continuity of deposit in the places where it has been found at all, consequently that hills of specular iron ore may be found in the regions of the Schuylkill, the Susquehanna, the Lehigh, or any other part of the long line of country which is traversed by the primitive mountains of the United States; and that in the present wasteful use of anthracite coal, and of limestone, it might be considerably less expensive to carry the specular iron ore to Scotland than the coals from Pottsville to Reading or the Lehigh. Such considerations render indispensable an equality in the art of smelting iron, in order to the preservation of the local advantage of the possession of the finest of ores. As Scotland, with advantages so inferior, still continues so strangely to supply the lower qualities of pig iron, so will it be not any very long time before the same people will be in possession of the manufacture of the higher varieties of iron, unless upon the rise of a more formidable opposition than any which yet can be discovered in the science of the iron manufacture of the United States. There is no mode of now maintaining an ascendancy but by the skill and enterprise of nations. Geology, chemistry, and mechanical science are rapidly assisting many nations to become rich from resources which were not formerly supposed to have an existence; and though the position of Pennsylvania is that of so undoubted an apparent magnificence, amidst the mineral deposites of so many valuable kinds, yet, without more rapid improvements in their use, neither the magnetic iron ores nor the anthracite coal fields appear to be destined to increase very materially the wealth and the commercial ascendancy of the Republic of the United States.

For the Journal of the Franklin Institute.

Fresh Water in Marine Boilers.

Much time and money have been wasted in vain attempts to perfect, for marine engines, a condenser that, while it would maintain a good vacuum, would also allow the condensed steam to be returned to the boilers as pure as it came from them. Of all those which have as yet been offered

to the public, that of Hall has met with the most success, or has at least been practically introduced into several steamers in England, where it was thought it would work a revolution in the economy of the marine engine. But although at first it gave much satisfaction, it was soon found to have defects which became of such a serious character as, in a short time, to almost, if not entirely, prevent its use. It was very expensive in its first cost, and, after short use, the tubes would leak and cause the water in the boilers to become salt; and, in addition to this, the tubes being vertical, the water from the steam first condensed was obliged to pass through the whole length of them, and as it adhered to their surface on its passage, their conducting power was much injured.

Since then, Mr. Howard, of England, has brought forward a refrigerator for cooling the injection water. By his arrangement the steam was condensed by a jet as usual, and then the condensed steam and water of condensation were made to flow through a large number of small horizontal tubes, having a current of cold water on their external surface. By this means the injection water was sufficiently cooled down to be again used. Although the arrangement possessed considerable merit, still it failed to succeed, probably from the liability of the tubes to leak from their constant contraction and expansion.

Several persons, in this country and in Europe, have brought forward fresh water condensers, but most of them have been modifications of Howard's arrangement, although they condense the steam, while he cooled the water, yet, in construction, they are the same or nearly so. They all have defects, or at least all that have yet been publicly tested have. The objections are, liability to leak, and by that means destroy not only their efficiency as fresh water condensers, but also to affect the vacuum. The requisites of a good condenser of this kind are, first, instant condensation, so that the ordinary vacuum may be maintained; second, impossibility of derangement, or as much security as the ordinary condenser allows.

The advantage of such an apparatus would soon be appreciated and generally adopted, but until it has been put successfully in practice, few if any of our steamers would venture to use it. With them success is of great importance, and, rather than risk partial failure, they will adhere to the old and well-tried condenser of Watt. But when at least 10 per cent. in fuel, besides the wear of boilers, may be saved by an apparatus that will answer the requirements above stated, I hope some of your numerous readers will take the subject in hand. Z.

For the Journal of the Franklin Institute.

Improvements in Sugar.

We were shown, a few days since, some samples of sugar made on the plantation of Messrs. Benjamin & Packwood, near New Orleans. These gentlemen have one of Rillieux's Patent Three-Pan Sugar Boiling Apparatus, and the sugar is made directly from the cane. Two of the samples were of white sugar, *crushed* and *flour*, and the third of molasses sugar. Their white sugar will compare favorably with that from our northern refineries, and has been pronounced by Professor M'Cullogh, in his report,

as equal in chemical purity to Lovering's single refined. From 12,000 to 15,000 lbs., of the white is produced daily, besides working over the molasses, which produces a sugar but little inferior to the best. We are also informed by Messrs. Merrick & Son, who are the agents for the apparatus, that, in consequence of its success, they have recently shipped one to the Island of Cuba, and are now building two for Mexico, the largest of which is a duplicate of that used by Benjamin & Packwood. In consequence of the quiet state of affairs in Mexico, several gentlemen there are turning their attention to the cultivation of sugar cane for home consumption, as the very expensive land carriage will prevent exportation.

B.

For the Journal of the Franklin Institute.

Economy of the Steam Engine.

The great expense of steam power is the cost of fuel, and although we cannot reduce the price per ton, which is regulated by its market value, we can readily reduce the number of tons used, by paying proper attention to the following items of loss.

1st, Insufficiency of power produced by having an engine too small for the work to be done, or boilers too small for the engine, but generally from both these causes combined.

2d, Imperfect setting of the boilers.

3d, By radiation: the tops of the boilers often being uncovered, and the steam pipes and cylinder nearly always so.

4th, By ignorance: the persons who have charge of many of our stationary engines being entirely unfit (by their want of knowledge of the principles of the engine) to keep all the parts properly adjusted.

The above are the principal causes of loss, and I shall, in your next, show the remedy, and adduce examples to prove the truth of my remarks.

W.

Means of Preventing Boiler Explosions. By A. C. Jones, Esq., *Civ. Eng.**

The recent explosions of steam boilers in this vicinity have brought out many contrivances, and revivals of old plans to *prevent* explosions. After it was *conceded* that high pressure steam boilers could be worked safely with proper care, then came various plans to make them *safer*. First on the list was lead plugs, riveted into holes made in the boiler sheet above the fire surface; next came fusible alloys, which would melt at a slight increase of temperature above that equivalent to the pressure of the steam in the boiler. Fusible alloys have entered into a large variety of arrangements for preventing explosions, by the order of the French Government; and also by the Committee on Explosions of the Franklin Institute, numerous experiments were made with alloys. We have had advocates for "Floats," "Balance Valves"—using the expansion of mercury, and rods of copper, arranged so as to open valves to permit the steam or water to

* From the New Orleans Daily Crescent, November 22, 1849.

escape and extinguish the fire, etc.—"Tell-tales," Whistles—looking *at* a steam boiler and calling it inspection—Lock-up safety valves, and a host of other things, mostly mechanical; and, in the wish to make the boiler *take care of itself*, almost entirely overlooking an article called *brains*, or, if you please, intellect.

In my time, persons having charge of steam engines were *engineers*—being paid such salaries as would command the best talent of the profession, and they had the sole control and management of the engines and boilers. How is it now? With some honorable exceptions, the pay of the engineer (I give the title) is a mere pittance, and he is in many cases a mere machine in the hands of the captain; and as a young man, of little experience, is more pliant than one that understands his business thoroughly, the latter is crowded out. Again, there is a class of men who are continually changing from one boat to another, and they endeavor to make better time than the trip before; all defects in the working of the engines by this class, is remedied by increasing the pressure of the steam.

Many prudent engineers, who understand their business, have been discharged for not increasing the head of steam in the boilers at the command of the captain. I will give a case in point, I am personally acquainted with a Mr. S., one of the best practical engineers, (now carrying on a large steam engine establishment in Philadelphia,) who was so discharged some years since, from a boat on the Mississippi river, *and on her return trip the boilers exploded!!*

Having had, during twenty-five years, much practical experience in working with nearly all the varieties of steam boilers, and having also paid much attention to those which have come under my notice after an explosion, I am satisfied that, in the greater number of cases, the explosion of the boiler was caused by gross neglect or ignorance on the part of those having charge of them. I, like other engineers, have had boilers at different times, under circumstances in which all the elements necessary for an explosion were present, but never had one to occur.

I will now give a few directions, (the boilers being assumed to be strong enough to bear the usual working pressure with safety,) which are invaluable to the young engineer, as they have carried others, beside myself, safely through a long practice. Of course these do not include everything necessary, but are of primary importance:

1st, Carry the water* as high as the boiler will allow, without working over into the cylinder.

2d, Never increase the pressure of steam to overcome the loss of power by leaks in the joints, derangement of the valve gear, etc.

3d, If, when at a landing, by any unforeseen cause, your water should get *too low* in the boiler, AVOID PUMPING IN WATER, OR RAISING THE SAFETY VALVE SUDDENLY, or by any other means disturbing the smooth surface of the water, kept so by pressure, *but dampen the fire at once*, and allow the boilers to cool down below their working temperature; after this is done, if time is an object, you can throw in a *very* small quantity of water, and

* Over eighteen years since, at Philadelphia, I stood *alone* as an advocate for carrying water high in the boilers, in opposition to the theory inculcated by English books, (written by arm-chair engineers,) of the necessity for a large space for steam room. I have experimented much on this matter, and still recommend carrying high water; and I have the satisfaction *now* of knowing that this is the practice of the best engineers of the country.

note its effect on the safety valve, and if sufficient time has elapsed, the lever of the safety valve will get heavier; in this case, you can set your pump to work and start a slow fire, limiting your supply of water, so as not to cool the boiler too soon and cause leaks. Do not confound this *decrease of pressure* with that which is caused by an excess of temperature, for you will find, by experimenting with an iron ladle heated to redness, that, by throwing in it small quantities of water at stated intervals of time, as it cools and gets black, there is a point of temperature at which the water is flashed instantly into steam, and *if it is your boiler which is at this degree of heat, and a sufficient quantity of water is thrown in at one time, an explosion is inevitable.*

To close this already long article, permit me to suggest (what will be considered an innovation by many here) that the furnace ends of the boilers be *aft*, so that the engineer on duty may have the firemen under his eye, and see the exact state of the fire at all times, instead of, as it is at present, conveying his orders through a tube and guessing how the fires are. Many will say that he can see by walking (from 30 to 40 feet) to the *hole* in the cotton bales, etc., forming part of the deck load; by doing this, he then has to break what should be the rule of every good engineer, "never to go out of sight or hearing of his engine."

If I have not overtaxed your space, I may at some future time make some remarks on the futility of some of the proposed safety plans connected with this important subject.

For the Journal of the Franklin Institute.

Steam for the Andes.

An iron steamboat of small size has recently been built by Mr. George Birkbeck, Jr., of New York, which, from its destination, merits some notice. The boat is 55 feet keel, 12 feet beam, and 5 feet hold. She is to be propelled by two high pressure engines of 10-horse power each, connected at right angles. Water wheels 10 feet diameter, and of wrought iron. The whole being fitted together in New York, and each piece marked before being shipped. No piece is to exceed in weight 350 lbs., as, on its arrival at Lima, it has to be transported on the backs of mules to its destination, Lake Titicaca, which is situated near the summit of some of the highest mountains in that country, and several miles above the level of the sea. As yet, commerce must be in its infancy in that elevated region, but the lake is 140 miles long, and its coast well timbered, and it is understood that much traffic would be the result of increased facilities. In case the first boat succeeds, a larger one is to be sent out immediately.

B.

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*Photography on Paper.**

At the Paris Academy of Sciences, M. Regnault presented, on behalf of M. Blanquart Evrard, of Lille, several specimens of photography on paper, obtained by means of a matrix on albumen, rendered sensible to the action of light by its admixture with the aceto-nitrate of silver, and spread

* From the London Artizan, for October, 1849.

in a thin layer on a plate of glass. The new matrices obtained by means of the preparations which M. Blanquart Evrard describes in his communication are unalterable to the light; lose none of their qualities however long the time they may be used; are capable of being renewed if by accident they should be lost, provided that one proof of the lost matrix remains; and lastly, can, at all times, and under all temperatures and variations of light, furnish satisfactory results. The following is the mode of preparation indicated by M. Blanquart Evrard:—

Collect in a deep vessel a certain number of whites of eggs—remove the whole of the solid or non-transparent part, and take care to protect it from dust; add 15 drops of a saturated solution of iodide of potassium; beat the eggs into a froth, and allow it to settle until the froth returns to the liquid state. Clean the glass which is to be employed with spirit of wine, place it on a support, beyond which the edges of the glass may project, and pour over it a sufficient quantity of albumen; spread this albumen over the whole surface of the glass, employing a piece of glass for this purpose, the edge of which comes in contact with the surface of the glass. This operation must be repeated several times, its object being to cover the surface of the glass with a perfect coating of albumen, so that it may remain well covered when hung up by one of its corners to drain off the excess of albumen.

After this last operation, the glass is placed quite flat and allowed to dry. The albumen having been well dried, the glass is submitted either to a very high temperature, or to what amounts to the same thing, to a very low temperature, until the layer of albumen presents an uniform crochet surface. Care, however, must be taken that this part of the process is not carried too far, lest the albumen should peel off. The glass having undergone this preparation, must next be submitted to the action of a solution of aceto-nitrate of silver (of the strength indicated in the communication of the 20th of January, 1847); care must be taken that the contact of the aceto-nitrate with the albumen shall be effected at one operation, for if the glass were several times immersed in the solution, different layers would be formed, arising from the contraction which the albumen undergoes on its combination with the aceto-nitrate. This part of the process may be accomplished most readily by proceeding as follows:—In a basin, a size larger than the albumenized glass, is put a solution of aceto-nitrate of silver, to the depth of a quarter of an inch; an inclination of 45° being then given to the basin, the edge of the glass is placed in the solution, the albumenized side towards the bottom of the basin; then, by a simultaneous movement, the glass is allowed to fall in the basin and the basin to regain its horizontal position on the table. This done, the glass is immediately removed from the basin, immersed in a basin of water, and briskly stirred for several seconds, and lastly drained by holding it by one of its corners and striking the opposite one briskly on the table. Glass thus prepared, becomes completely photogenic. It may be employed indifferently either in a moist or a dry state, if it be required for use at a distance or on a journey. The impression may even be made to appear after exposure to the camera obscura, either immediately or after a return from a journey. This operation is performed (as M. Blanquart Evrard has already indicated for paper in his communication to the Academy in November, 1847,) in

a bath of a saturated solution of gallic acid; it will, however, be useful, in order to give the impression a full effect, to add a little aceto-nitrate of silver to the solution of gallic acid. It will be prudent to withdraw the impression from its immersion in the gallic acid before its different parts acquire the tone desired, for if the action be pushed too far, the deep tones it then presents cannot be afterwards diminished; whereas, on the other hand, if the shades are too faint, the impression may, without danger, be again subjected to the action of the gallic acid, notwithstanding the matrix had already been served to produce a great number of impressions. After this operation, the glass should be washed in a large quantity of water, then dipped into a solution of bromide of potassium, (20 parts to 100 of water,) and lastly again washed in a large quantity of water, and dried in a darkened room in an horizontal position. Treated in this way, the albumen on the glass acquires such a degree of hardness and solidity, that when it is required to destroy an incomplete impression, in order to use the glass again, it is necessary to have recourse to a very powerful chemical agent, such, for instance, as the cyanide of potassium, to remove the coating of albumen.

On Copper containing Phosphorus, with details of Experiments on the Corrosive Action of Sea Water on some varieties of Copper. *By* Dr. Percy.*

Upon analyzing a specimen of copper to which, when in a state of fusion, some phosphorus had been added, it was found that it contained a considerable quantity of phosphorus, and also a large portion derived from an iron rod employed in stirring the mixture at each addition of the phosphorus. The copper employed was of the "best selected;" it appeared to be harder than copper treated with arsenic. The details of the analysis of 116·76 grains was given, the result of which was—

Phosphorus,	0·93
Iron,	1·99

A second analysis gave—

Copper,	95·72
Iron,	2·41
Phosphorus,	2·41
	100·54

It has long been stated that a very small quantity of phosphorus renders copper extremely hard, and adapts it for cutting-instruments—but such an alloy as that formed by Dr. Percy has not previously been formed. It is a remarkable fact that the presence of so large a quantity of phosphorus and iron should so little affect the tenacity and malleability of the copper. The effect also of phosphorus in causing soundness in the casting of copper is interesting, and may be of practical importance.

Remarks.—Captain James, superintending engineer at the Woolwich dockyard, said that the rapidity with which copper sheathing sometimes decays was surprising; in five months it sometimes decays completely. Some of the old copper had lasted forty years; and, for the purpose of de-

* From the London Civil Engineer and Architect's Journal, for November, 1849.

termining the cause of this difference, he made a series of experiments on all the copper which had been used in her Majesty's dockyard. By steeping these different coppers in salt water for nine months, a series of actions set in, which, by subsequent weighing, were accurately determined. The following table exhibits the results of these experiments:—

	Grains.
Electrotype copper, loss per square inch, . . .	1·40
Selected copper, ...	1·10
Copper containing phosphorus, ...	0·00
Copper from the "Floric,"	1·12
Dockyard copper, No. 1, ...	1·66
Ditto No. 2, ...	3·00
Ditto No. 3, ...	2·48
Ditto No. 4, ...	2·33
Muntz's metal, ...	0·95

Mr. Phillips inquired if the specimens were wholly exposed to the water, or were only partially exposed, so as to allow the action of air, as in the latter case the chloride of magnesium in sea water would give rise to the formation of an oxichloride, but which would not be formed if air were absent. Captain James said they had been wholly immersed.—*Proc. Brit. Assoc.*

Method of Regulating the Flow of the Injection Water into the Condenser, applicable principally to Marine Engines. *By* G. J. Cunnack.*

The injection water, as is at present the general practice, being allowed to flow into the condenser in an uninterrupted stream, and requiring the constant attention of the engineer, so as to proportion the quantity of injection to the bulk of steam proceeding from the engine, this latter must be subject to great variation, particularly in the case of marine engines when the paddles are exposed to a heavy sea, which at times almost brings them to a stand-still; and, as the injection water still flows, the air pumps become subjected to a severe strain resulting from the partial choking produced by the excess of water. On the other hand, should the speed of the engines become accelerated, and the injection remain unaltered, a loss of power must ensue from imperfect condensation.

The manner in which it is proposed to remedy these irregularities, is by causing the difference of pressure in the condenser to act on a throttle valve in the injection pipe, similar in construction and effect to the one in the steam pipe connected with the governor in land engines. A small cylinder of any requisite diameter, open at the bottom to the condenser, and at the top to the atmosphere, is fitted with a piston, the rod of which is connected by means of levers, on the one side with a balance or spring, and on the other with the governing lever of the throttle valve in the injection pipe. The lower end of the cylinder being open to the condenser, the piston will be subjected to the pressure arising from the vapor within it, this being usually computed at 5 lbs. per square inch; the atmosphere acting on the top of the piston with a force of 15 lbs. to the inch, would leave a force tending to depress it in the cylinder of 10 lbs. A weight, acting

* From the London Artizan, for December, 1849.

by means of the long lever, is so arranged as to compensate for this difference, and keep the piston in equilibrium so long as the pressure in the condenser remains at the proper point, namely, 5 lbs. to the square inch.

Supposing that, from an insufficient supply of injection water, this pressure should be exceeded, the piston will rise, and lifting with it the end of the lever connected with the throttle valve in the injection pipe, will increase the flow of water and produce the required effect of more perfectly condensing the exhaust steam. On the other hand, should the flow become too great, so as to carry the amount of rarefaction too far, the piston would be depressed from the preponderance of atmospheric pressure, and the action on the throttle valve would be reversed, so as to diminish the quantity of water flowing through it. The piston, not being exposed to the action of heat, can be easily kept air tight by a packing of soft leather, and, if necessary, a small quantity of oil kept on the top of it would be an additional security against leakage. There is a spring in the cylinder, to prevent the too sudden rise of the piston, and ensure its gradual action on the throttle valve of the injection pipe. The latter valve is supposed to be placed between the injection cock and the condenser.—*Proc. Roy. Cornw. Polyt. Soc.*

For the Journal of the Franklin Institute.

Performance of the Steam Ship "Philadelphia."

I send you the performance of this ship, as taken from her log-book, during her recent trip to Havana, via Charleston and Savannah. She left here on the 20th December, at noon, and made Cape Hatteras in 27 hours, with an average pressure of 16 lbs. of steam, cutting off at one-third; revolutions per minute, 15. After passing the Cape, the wind came ahead and soon increased to a gale of great force, and blew for 24 hours, when it gradually fell off. During the gale the engines were worked at full stroke, and the pressure kept at 15 lbs.—engines making 9 and 10 revolutions per minute. The severity of the gale may be imagined, when the distance of 70 miles was all that could be made in 22 hours. The wind continued ahead for the balance of the distance to Charleston,—time from dock to dock, 76 hours.

The ship remained at Charleston four days, being two days more than was intended. This was found necessary, as the pipes to the brine pumps, and also the blow-off pipes from the boilers, were known to be partially obstructed; and, on examination, small pieces of wood and other refuse matter (which must have been left in the boilers) were found and taken out. She left Charleston on Friday, the 28th, and Savannah on the 29th, for Havana, and the run from port to port was made in 69 hours. Several hours were lost on this passage from keeping too far out from the shore, and thus having a portion of the Gulf Stream to contend with; still, as this was the first trip, it was perhaps more prudent to do so.

She remained at Havana until the 10th of January, and while there took on board 50 tons of Scotch bituminous coal. On the return trip to Savannah, it was found that it required $1\frac{2}{3}$ tons of that coal to give the same effect as 1 ton of anthracite coal, her usual consumption being 1 ton of the

latter per hour. The run from Havana to Savannah bar was made in 49 hours, which is as quick a passage as has ever been made. The run from Savannah bar to Charleston bar was made in 6 hours, and from Charleston to Philadelphia in 65 hours from wharf to wharf. Although she had never been at sea before this her first trip, and had been only tried for a few hours in the river, yet she was ready on her arrival for any voyage.

Since her return she has been sold to Messrs. Howland & Aspinwall, at an advance of $25,000 on her cost, and takes her place in their California line, via Chagres, from New York, on the 7th of this month. On her trip round to New York, she made the distance from Sandy Hook to the East River (18 miles) in 1 hour and 15 minutes, and her appearance is very highly commended by the press of that city.

The builders of the "Philadelphia" will probably now construct a vessel somewhat smaller than her for the Southern trade, which, in connexion with the "Osprey," now belonging to them, will form a weekly line South.

W.

On the Preservation of Water. By M. Perinet.*

M. Perinet, ex-Professor of the Hôpital Militaire d'Instruction, has succeeded in preserving water in a sweet state, by placing 1½ kilogramme of black oxide of manganese in each cask of water containing 250 litres. He has kept this water for seven years in the same barrels, and exposed them to various temperatures; at the end of that time he found it as limpid, free from smell, and of as good a quality, as at the beginning of the experiment. The above is equal to 6½ lbs., to a butt of 108 gallons.

On the Influence of Boracic Acid on Vitrification.†

M. Maes, manufacturer of flint glass, has, conjointly with M. Clemandot, long paid attention to the above-named subject. The principal results hitherto obtained are:—1st, borosilicate of potash and lime; 2dly, borosilicate of potash and zinc; 3dly, borosilicate of potash and barytes; 4thly, borosilicate of soda and zinc.

The borosilicate of potash and lime was formed with the intention of producing in close vessels with coal furnaces, the best imitations of Bohemian glass. In the *Compte Rendu de l'Exposition Autrichienne*, 1845, published by M. Peligot, it appears that, in order to make the purest and most durable glass in Bohemia, they use with 100 parts of silica, 12 parts of unslaked lime, and only 28 parts of carbonate of potash. From this we must conclude that the glass is better the less potash and the more lime it contains.

The above proportions yield a glass which is infusible in the furnaces employed by M. Maes. The addition of a few hundredths of boracic acid is sufficient to occasion fusion, and the resulting product possesses all the limpidity, splendor, and hardness which can be desired.

This first experiment naturally suggested the advantage which might be derived from the solvent power of boracic acid, so as to introduce bases

* From the London Civil Engineer and Architect's Journal, for September, 1849.

† From the London, Edinburgh, and Dublin Philosophical Magazine, for December, 1849.

into glass which had not hitherto been employed, as borosilicate of potash and zinc, and that of potash and barytes. The borosilicate of potash and zinc appeared to impart all the qualities of a pure and durable glass. As to the borosilicate of potash and barytes, it was prepared from native carbonate of barytes, contaminated with sulphate of barytes and a ferruginous gangue. If then it be less colorless than the zinc glass, the color is certainly accidental; on again making it with pure carbonate, this imperfection would unquestionably disappear.

The beauty of borosilicate of potash and zinc led to the comparative trial of borosilicate of soda and zinc; this, although inferior to the potash, incontestably excelled all the soda glasses compared with it.

To recapitulate: the borosilicates are chiefly remarkable for their transparency and hardness. They derive these important qualities from reducing considerably the potash and soda, which almost always are in excess in common glass; and every one knows that glass which is too alkaline, is cloudy, soft, and hygrometric.

These observations, in the opinion of the author, warrant the conclusion, that boracic acid must before long contribute to the perfection of glass for optical purposes, and M. Maes proposed to prepare borosilicates of great density, with lead, bismuth, &c., besides barytes.—*Compt. Rend., Oct.* 22, '49.

Analytical Investigations of Cast Iron. By Mr. Wrightson.*

The analysis showed the influence of the hot blast in producing the so-called "Cold Short Iron," by occasioning an increased reduction of phosphoric acid, and the consequent increase of phosphorus in the "hot blast" iron. The respective per centages were—

	1	2	3	4	5	6	7
Cold Blast,	0.47	0·41	0·31	0·20	0·21	0·03	0·36
Hot Blast,	0·51	0·55	0·50	0·71	0·54	0·07	0·40

The irons differed also considerably as to the state in which the carbon was contained in the hard white iron, resembling impure steel, containing nearly all its carbon in a state of chemical combination, whilst the carbon contained in the grey and mottled varieties of iron was principally contained only as a mechanical mixture. The presence of sodium and potassium in all the specimens examined was also noticed for the first time, and it was thought probable that these might materially affect the qualities of the metal.

Remarks.—Mr. Phillips pointed out the loss of carbon, which, in the method described, would arise from the use of hydrochloric acid, giving rise to an oily product; to which Mr. Wrightson replied that he had determined the carbon by an independent method. The President inquired if Mr. Wrightson had sought arsenic in all his analyses? Mr. Wrightson replied that he had not found it in some, and did not, in consequence, look for it in the others. The President objected that it was as important to determine the absence as the presence of so important an element as arsenic. In reply to an inquiry, he said that, in examining the slags of furnaces in many countries, he had only discovered phosphoric acid in one from Belgium.—*Proc. Brit. Assoc.*

* From the London Civil Engineer and Architect's Journal, for November, 1849.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, January 17th, 1850.

Samuel V. Merrick, President, in the chair.
Thomas Fletcher, Vice President.
Isaac B. Garrigues, Recording Secretary.
John F. Frazer, Treasurer.

The minutes of the last meeting were read and approved.

Letters acknowledging donations were read from the Royal Institution, the Royal Institute of British Architects, and the Statistical Society, of London, and the Royal Irish Academy, Dublin.

Donations were received from the Society of Arts, the Statistical Society, and the Royal Astronomical Society, London; Hon. Joseph R. Chandler, U. S. Congress; R. P. Anderson, Esq., Washington City, D. C.; Lieut. M. F. Maury, U. S. Navy; Thomas H. Forsyth, Esq., and Benj. Matthias, Esq., Senate of Pennsylvania; Franklin Peale, Esq., and Thomas J. Weygandt, Esq., Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of receipts and payments for the month of November, and also his annual statement for the year 1849.

The Board of Managers and the Standing Committees reported their minutes.

The annual statement of the Committee on Publications was read.

The Committee having charge of the arrangement of the Geological Specimens presented their report, which was read.

The Committee on Exhibitions presented their report on the application of Messrs. Charles Harkness & Son, and were discharged from the further consideration of the subject.

The Trustees of the Elliott Cresson Medal Fund presented their report, in which they recommend the following resolution, which was adopted:

Resolved, That the Institute will award the Elliott Cresson Medal, struck in silver, for such articles of African production, grown or made by the Pennsylvania settlement in Liberia, as Elliott Cresson, Esq., may designate, according to the terms proposed in his letter of the 12th inst.

An application was made for permission to make extracts from the reports of the Judges on Books and Stationary at the Exhibitions of 1848 and 1849, which was not granted.

On motion, it was

Resolved, That the Committee on Exhibitions be requested to issue to Mr. Charles Harkness & Son a First Premium, for the best lot of ready-made Clothing at the last Exhibition.

Resignations of membership in the Institute were read and accepted (2).

New candidates for membership in the Institute (12) were proposed, and those proposed at the last meeting (22) were elected members of the Institute.

The Tellers of the Annual Election for Officers, Managers, and Audi-

tors, for the ensuing year, reported the result of the Election, when the President declared the following gentlemen duly elected:—

SAMUEL V. MERRICK, *President.*
Thomas Fletcher, } *Vice Presidents.*
Abraham Miller, }
Isaac B. Garrigues, *Recording Secretary.*
Solomon W. Roberts, *Corresponding Secretary.*
John F. Frazer, *Treasurer.*

MANAGERS.

Matthias W. Baldwin,
Frederick Fraley,
John Agnew,
John Wiegand,
Samuel Hufty,
John C. Cresson,
Andrew M. Eastwick,
Ambrose W. Thompson,
Thomas U. Walter,
John H. Towne,
Edwin Greble,
David S. Brown,
Thomas S. Stewart,
Owen Evans,
Cornelius A. Walborn,
Alan Wood,
John E. Addicks,
Williams Ogle,
Asa Whitney,
Isaac S. Williams,
William E. Morris,
Edmund Draper,
James P. Ellis,
Robert P. King.

AUDITORS.

Stephen Byerly,
Joseph Cresson,
Algernon S. Roberts.

Prof. Cresson described to the meeting the plan of a new gas-holder, of 140 feet diameter by 70 feet high, (being the largest hitherto made,) which is in progress at the Philadelphia Gas Works. It is on the telescopic plan, and will afford a more economical and convenient stowage for gas than those heretofore erected. Some discussion took place among the members respecting the details.

Some specimens of Rolled Zinc, of exceeding thinness, made from the Calamine of New Jersey, were shown by the Chairman, which led to a discussion as to the pureness of the Zinc. The President, Mr. Merrick, referred to the first introduction of Zinc, as the base of a white paint, in this city, to the year 1820.

Some remarks were made by the Chairman respecting the wooden Railroad Bridge in progress on Market street, the centre span of which exceeds 200 feet. Numerous instances were cited of the failure of wooden bridges of large span, in this country and in Europe. The engineer of this bridge not having arrived with the drawings, the discussion was postponed until the next meeting.

Mr. Elliott Cresson exhibited samples of Palm Oil, Syrups, Camwood, &c., the production of the colony in Liberia.

The Chairman introduced the subject of Sandstone and other building materials, and adverted to the causes of destructibility and durability respectively,—the methods which have been resorted to to protect them,—the varying degrees of success attending such efforts, and described the me-